# INDIAN ASSOCIATION FOR CRYSTAL GROWTH

*IACG* NEWS LETTER

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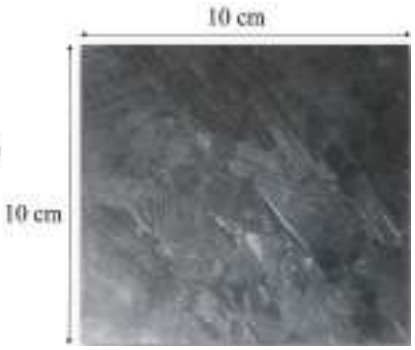
YEARLY BULLETIN OF CRYSTAL GROWTH RESEARCH AND APPLICATIONS

January 2018 | Issue 30


## India's first mc-Si crystal with India-Made DS Crystal Growth equipment

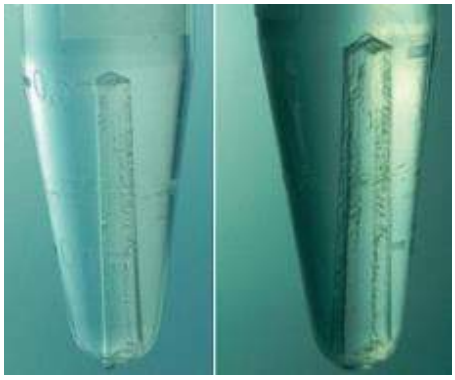

mc-Si crystal ingot


mc-Si brick

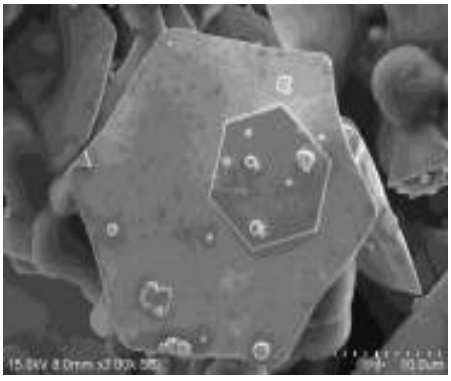



mc-Si wafer

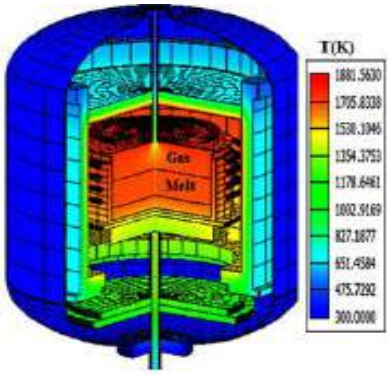
The commercial unidirectional phase matching KDP crystal



Bulk growth of vanillin single crystals: A new approach

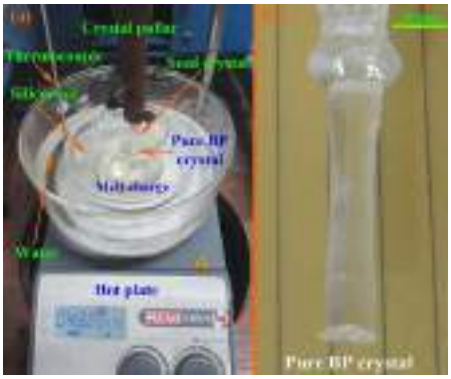


Forming nano and micro crystals : A new and novel technique




Global modelling on DS furnace for growing mc-silicon crystals

Germanium (Ge) single crystal (950 g) grown in CZ furnace




Modified low temperature CZ growth: A low cost CZ system

# RECENTLY GROWN TECHNOLOGICALLY IMPORTANT SINGLE CRYSTALS

$AgBiS_2$ - K. Ramachandran, Dr. P. Ramasamy, SSNCE


$BaF_2$ - Dr. S. C. Gadkari BARC, Mumbai

1,3,5-Triphenylbenzene - Dr. S. Kalainathan, VIT-Vellore

Phase matched Benzophenone - Dr. Sunil Verma et al, RRCAT

1,3,5 TPB-Dr.K.Sankaranarayanan Alagappa University

β-MHB - Dr.K.Srinivasan Bharathiyar University

SR-Na(I)-KDP - Dr.S.P.Meenakshi -sundaram, Annamalai Univ.

L-APT-Dr. N. Vijayan NPL, New Delhi

M2C4N-Dr.S.Brahadeeswaran BIT-Anna University

Stilbene - Dr. R. Ramesh Babu Bharathidasan University

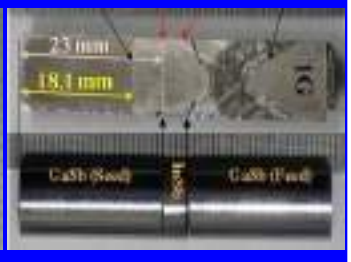
DPGP - Dr. K. Sethuraman Madurai Kamaraj University

Dye added KAP - G. Babu Rao, Dr.P.Rajesh, SSNCE

SR - KDP - Dr. S.K.Sharma et al, RRCAT

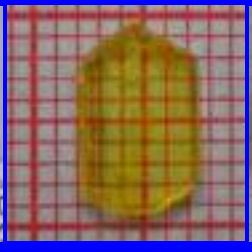
GuAB - Dr. P. Murugakoothan Pachaiyappa's College

LsKDP - Dr.R.Arun Kumar PSG College of Technology



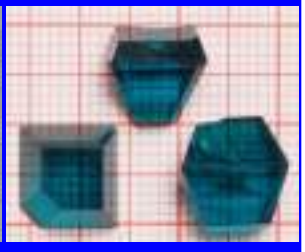

1G-GaSb – Dr. M. Arivanandhan, Anna Univ.

SR method grown NPLi Dr.S.Jerome Das, Loyola College



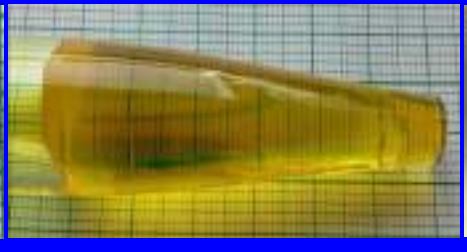
HEANP - Dr. R. Nagalakshmi, NITT

X-KDP-J.Thirupathy, Dr.S.A.Martin Britto Dhas, Sacred Heart College



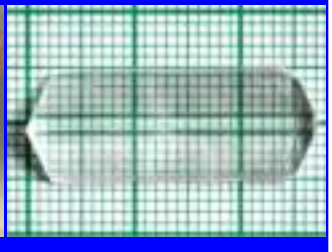
NSH-Dr.T.Balakrishnan Periyar EVR College

2PA5S - Dr. R. Mohan Kumar, Presidency College



SR - 2APNP - P. Karuppasamy Dr. Muthu Senthil Pandian, SSNCE

PMN-PT - Dr.Binay Kumar University of Delhi



BTZC - Dr. Mihir. J. Joshi Saurashtra University

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**IACG NEWS LETTER**
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## *PREVIOUS 4 ISSUES - IACG NEWS LETTERS*


**ISSUE: 26, 2014**


**ISSUE: 27, 2015**


**ISSUE: 28, 2016**


**ISSUE: 29, 2017**

# Editorial Message

It is a great pleasure for me to present you the 30th issue of IACG NEWS LETTER-2018. An enthusiastic note is that the number of the Crystal Growth members is increasing tremendously. To date we have about 600 Crystal Growth research active life members. The immense support and encouragement we have been receiving from the Indian Crystal Growth Community has given us enthusiasm to bring out the 30th Issue of our IACG News Letter-2018. This newsletter presents the achievements by the Indian Crystal Growth community. The objectives of the association are to promote, encourage and develop the theory and practice of growth of Crystals, to organize Conferences, Seminars, Workshops, Hands on Training etc., in various parts of the country, to educate the people at various levels and offer a proper platform for reporting and discussing new developments in the field of Crystal Growth. I am happy to note that the number of sanctioned Crystal Growth Projects from national funding agencies are increasing day-by-day. This year alone 15 Crystal Growth projects have been sanctioned for about 35.4 crore to our IACG members from DST, SERB, DRDO, BARC, UGC-DAE CSR, TNSCST, IUAC and CSIR. 38 Ph.D. theses have been submitted/completed in Crystal Growth during 2017. Several Crystal Growth researchers have got National Fellowship to work in various reputed National and International research laboratories and universities. Many of our researchers have got Young Scientist Award, Best Thesis Award, Best Innovation Award, Best Crystal Display Award and Best Paper Presentation Awards for their outstanding work in Crystal Growth. MoU has been signed between GRD Centre for Materials Research, PSG College of Technology, Coimbatore and M/s. Indfurr Industries, Chennai, to develop sophisticated lab equipment for growing technologically important single crystals. Another MoU has been signed between Crystal Growth and Nanoscience Research Centre, Government College (A), Rajamahendravaram, A.P. and Conn Centre for Renewable Energy Research, University of Louisville, USA to develop new phosphors crystalline materials.

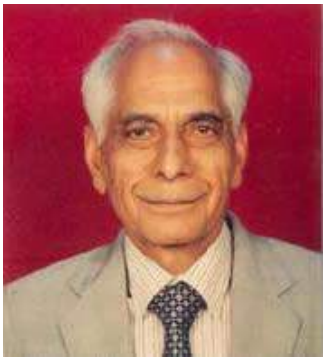
IACG has successfully organized TWENTY ONE Crystal Growth seminars, many of them with International Participation. All major Indian Crystal Growth laboratories and research institutions participate in the National Seminar on Crystal Growth & Applications (NSCGA). XXI NSCGA-2017 was organized at National College, Tiruchirappalli during 6-8th March 2017. Several eminent scientists in India and few scientists from abroad participated and delivered their lecture in this event. The XXI NSCGA-2017 provided a platform for the research community in Crystal Growth and characterizations to meet, discuss and share the latest advances in these fields. Three days of togetherness has developed a strong and healthy support between the experts in the field of Crystal Growth. Interaction with the eminent personalities has been a great motivation to the research scholars and post graduate students who participated in the seminar. Discussions on student exchange programme with reputed institutions were initiated. To recognize Dr.R.Gopalakrishnan's research contribution, **"Dr.R.Gopalakrishnan National Award for Best Thesis in Crystal Growth"** was introduced by IACG. The young researchers who submitted thesis in the field of Crystal Growth within the previous one year period are eligible to apply for this award. **Dr. P. Vijayakumar**, Crystal Growth Section, IGCAR, Kalpakkam, Tamilnadu, **Dr. K. Tirupugalmani**, Department of Physics, BIT-Anna University, Tiruchirappalli, Tamilnadu and **Dr. K. Boopathi**, Crystal Growth Centre, Anna University, Chennai, Tamilnadu received this Award in 2017.

NSCGA is held in different cities as annual event. This year it is being organized at PG and Research Department of Physics, Sacred Heart College (Autonomous), Tirpattur during 29-31st January 2018. The present "XXII National Seminar on Crystal Growth and Applications-2018" is a major event for us involving several Senior and Young Scientists. This year the topics of symposium include: Growth of Single Crystals, Crystal Growth Equipment and Techniques, Modelling and Simulation for Crystal Growth and Properties, Characterization Techniques, Nano Crystals, Applications of Single Crystals, Devices based on Single Crystals and Their Societal Benefits. The current seminar includes 35 Invited Lectures, 15 Dr.RG National Best Thesis Award presentations, 10 Best Crystal Display Award presentations and more than 250 contributed papers as Oral and Poster presentations from many National Laboratories, Universities and Research Institutes.

Every effort has been made to bring to you the most of the news in a brief manner.

**Dr. Muthu Senthil Pandian**
Editor, Indian Association for Crystal Growth (IACG), News Letter

# INDIAN CRYSTAL GROWERS WHO HAVE DONE CONSIDERABLE CRYSTAL GROWTH RESEARCH



**Prof. A. R. Varma**
NPL, New Delhi

**Prof. Krishan Lal**
NPL, New Delhi

**Prof. P. Krishna**
BHU, Varanasi

**Prof. G.C. Trigunayat**
University of Delhi

**Prof. A. R. Patel**
S.P. University

**Prof. S. C. Sabharwal**
BARC, Mumbai

**Prof. S.M.D. Rao**
BARC, Mumbai

**Prof. J. R. Pandya**
Baroda University

**Prof. B.S. Shah**
Gujarat University

**Prof. H.L. Bhat**
IISc, Bangalore

**Prof. V.K. Wadhavan**
BARC, Mumbai

**Prof. P.N. Kotru**
Jammu University

- **Prof. M.S. Joshi**, Sardar Patel University, Gujarat
- **Prof. B. Ghosh**, Bhaba Atomic Research Centre (BARC), Mumbai
- **Prof. S. Radhakrishna**, Indian Institute of Technology (IIT), Madras
- **Prof. R. K. Bagai**, Solid State Physics Laboratory (SSPL), Delhi
- **Prof. W.N. Borle**, Solid State Physics Laboratory (SSPL), Delhi
- **Prof. M. A. Ittyachan**, Mahatma Gandhi University, Kerala

# CRYSTALS GROW CRYSTALS IN SSN

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Dr. Sadhasivam
Dr. R. Sivasankari
Dr. S. Siva Bala Solangi
Dr. S. Rama
Mr. T. Arivazhagan
Ms. Jebha Anandhi
Mr. R. Kameshwaran
Mr. M. Arul Mani

Dr. N. P. Rajesh
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Dr. R. Bairavaganesh
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Mr. P. Karuppasamy
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Mr. R. Nagaraj

Dr. P. Nagapandi Selvi
(Dr. R. Gopalakrishnan)

Mr. M. Thiyagarajan
Mr. G. Anbu
Mr. M. Avinash kumar

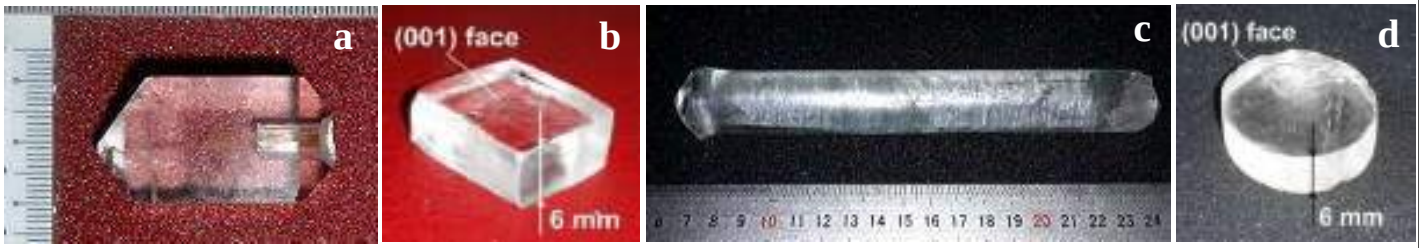
## Crystal Growth Associations of Various Countries

- American Association for Crystal Growth (AACG), **America**
  *http://www.crystalgrowth.org/*
- Australian Crystal Growth Community (ACGC), **Australia**
- British Association for Crystal Growth (BACG), **United Kingdom**
- Brazilian Community of Crystal Growers (BCCG), **Brazil**
- Bulgaria Crystal Growth Association (BCGA), **Bulgaria**
- Chinese Association for Crystal Growth (CACG), **China**
- Czechoslovak Association for Crystal Growth (CACG), **Czechoslovakia**
- Dutch Association for Crystal Growth (DACG), **Netherlands**
  *http://www.dacg.nl/welcome-en.html*
- German Association for Crystal Growth (GACG), **Germany**
- Hungarian Association for Crystal Growth (HACG), **Hungary**
- Indian Association for Crystal Growth (IACG), **India**
  *http://www.ia-cg.com/index.html*
- Italian Crystal Growth Community (ICGC), **Italy**
- International Organization for Crystal Growth (IOCG), **USA**
  *http://www.iocg.org/*
- Japanese Association for Crystal Growth (JACG), **Japan**
  *http://www.jacg.jp/jacg/english/top.html*
- Korean Association of Crystal Growth (KACG), **Korea**
  *http://eng.kacg.net/*
- Mexican Society of Crystallography and Crystal Growth (MSCCG), **Mexico**
- Polish Society for Crystal Growth (PSCG), **Poland**
- Russian Crystal Growth Community (RCGC), **Russia**
- Romania Association for Crystal Growth (RACG), **Romania**
  *http://romscgs.fizica.unibuc.ro/*
- Swiss Crystal Growth and Technology Section (SCGTS), **Switzerland**
  *http://www.sgk-sscr.ch/en/swiss-society-for-crystallography/*
- Spain Community of Crystal Growers (SCCG), **Spain**
- Taiwan Association for Crystal Growth (TACG), **Taiwan**
- Ukrainian Association for Crystal Growth (UACG), **Ukrainian**
  *http://isc.kharkov.ua*

# The commercial unidirectional phase matching KDP single crystal

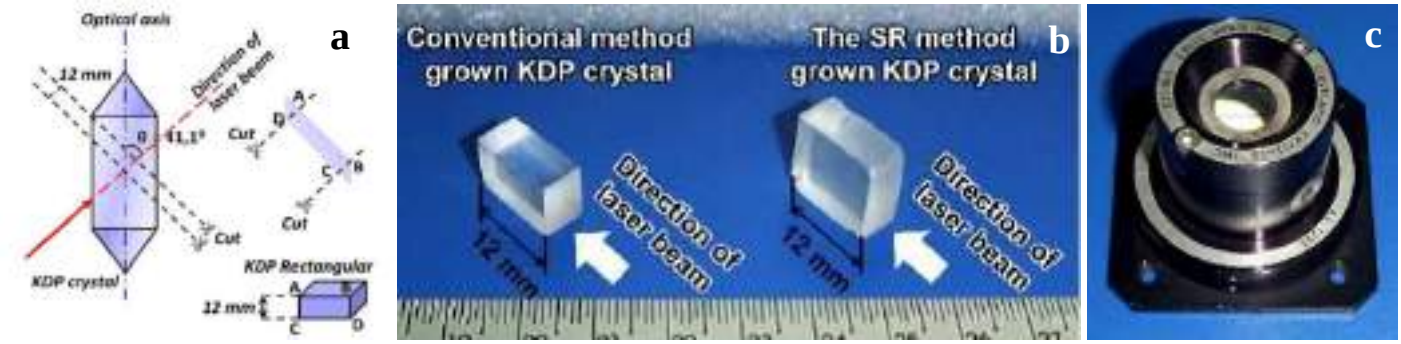
**Vinh Trung Phan, Anh Quynh Le, Dat Thanh Huynh**
Faculty of Physics, University of Science, Vietnam National University, Ho Chi Minh City, Vietnam

Potassium Dihydrogen Phosphate (KDP) crystal has been studied since the early 1930s. It has many important applications, such as the electro-optic modulator, Q-switches, the ultrasonic transducer, the shutter for high-speed photography, frequency doubling and high power laser frequency conversion for fusion research. In response to these applications, the high quality KDP single crystals are required. The common method of KDP crystal growth is the lowering of the temperature of saturated KDP solution which is held in a cylindrical tank. The disadvantage of this method is the spontaneous appearance of crystalline clusters at the bottom of the tank which retard the growth of the main crystal. Sankaranarayanan and Ramasamy have proposed a new method of growing crystal by designing the Y-shaped solution tank. In this study, the KDP single crystals were grown by the SR method. These crystals have better quality, fewer defects, higher hardness and density, and especially material saving compared to ones from the conventional method.




*(a) The KDP crystal grown by conventional method (b) The conventional method KDP crystals after being cut and polished (c) The KDP crystal grown by the SR method (d) The SR method KDP crystals after being cut and polished*

The unidirectional phase-matching crystals were investigated SHG effect by the Nd: YAG laser whose wavelength of 1064 nm and maximum power of 1W. The optical system of investigating SHG effect included Nd: YAG laser, sensor card for 1064 nm, an optical filter, digital laser power meter, and some other optical components. Also, a commercial unidirectional phase-matching KDP crystal was also prepared to compare with KDP samples in the present work. the SHG efficiencies of the SR method grown KDP crystal are higher than that of conventional crystal at laser power values of 0.179 to 1W. Typically at 1W power, the SHG efficiency of the SR method grown KDP crystal is about 122% greater than the conventional method grown KDP crystal, and approximately near that of commercial crystal (about 93%). These results showed the superiority of the SR method in enhancing crystal quality. The SHG conversion efficiencies of the SR method grown KDP crystal have not reached the values of commercial KDP crystal because of several reasons, among them mainly the limitation of surface polishing and lack of AR (antireflective) coating.




*(a) Illustrations to cut KDP crystal to the phase-matching angle (b) Phase matching KDP crystal samples (c) The commercial unidirectional phase matching KDP crystal*

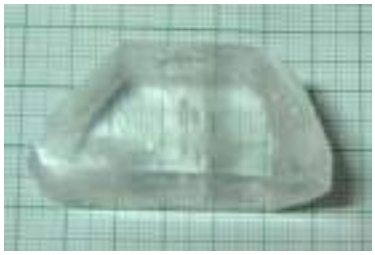
**Reference**
[1] Vinh Trung Phan, Anh Quynh Le, Dat Thanh Huynh, American J. of Phys. Appl. 6 (2018) 11-17.

# Phase matched oriented growth of benzophenone NLO crystal for Second Harmonic Generation (SHG) applications

**Sunil Verma, O.C. Viji*, Yeshpal Singh, S.K. Sharma, K.S. Bartwal, A.K. Karnal**
Solution Crystal Growth Lab, Laser Materials Section,
Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452013, Madhya Pradesh (M.P.)
*International School of Photonics, Cochin University of Science and Technology, Cochin-682022, Kerala

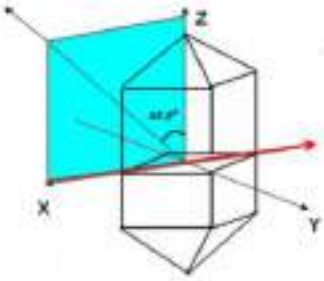
Enhancement in usable volume of benzophenone NLO crystal for SHG device applications is reported by growing it directly along phase matching direction using unidirectional solution growth technique [1]. When SHG element is cut from conventionally grown benzophenone crystal, major volume of the crystal goes waste, resulting in only ~20% of the crystal volume useful for SHG applications. However, SHG device purpose yield of this crystal increases to ~ 90% when it is grown directly along phase matching direction by unidirectional solution growth method. The growth methodology is described below schematically.

***STEP 1:*** *Conventional top hanging growth morphology*



| Face1 | Face2 | Angle |
|---|---|---|
| (-1 -1 0) | (-1 1 0) | 80.63 |
| (1 -1 0) | (1 1 0) | 80.63 |
| (1 1 0) | (-1 1 0) | 99.36 |
| (-1 -1 0) | (1 -1 0) | 99.36 |

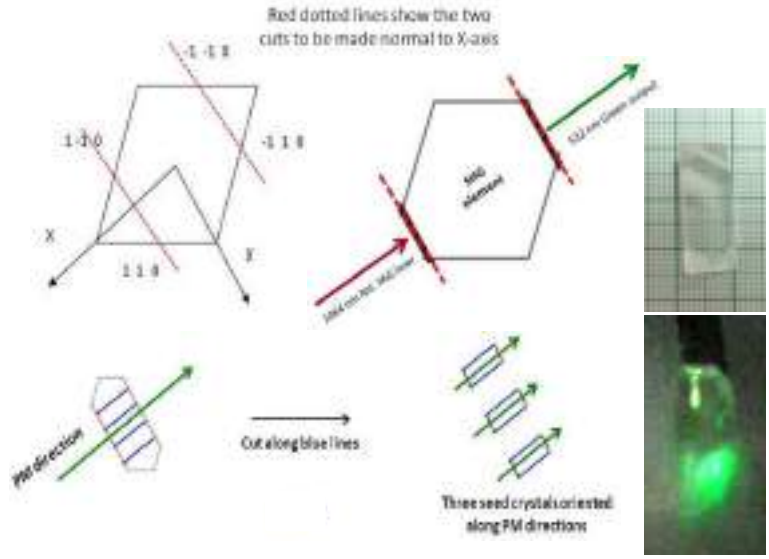
***STEP 2:*** *Interfacial angles and phase matching directions*




θ = 45.5º
Angle made by PM direction with the Z-axis. It will result in a cone of angle θ.

φ = 0º
Angle between projection of the vector making an angle θ with the Z-axis makes with the X-axis

***STEP 3:*** *Crystal cutting procedure to obtain SHG element, frequency conversion confirmation and SHG direction oriented seed crystals*




***STEP 4:*** *SHG oriented seed in ampoule and final unidirectional growth along phase matching direction*

| Growth technique | Crystal volume for SHG application |
|---|---|
| Conventional top hanging growth | 20% |
| Phase matching direction growth | 90% |

**Reference**
[1] Sunil Verma, O.C. Viji, Yeshpal Singh, S.K. Sharma, K.S. Bartwal, A.K. Karnal, 26th DAE-BRNS National Laser Symposium, 20-23 December 2017, BARC, Mumbai, pp. 37.

# Characterization Facilities Availability

| | |
|---|---|
| **Single Crystal X-Ray Diffraction (SXRD)** | |
| Bharathiyar University, Coimbatore, Tamilnadu | Dr. K. Srinivasan, Professor and Head, Department of Physics, Bharathiar University, Coimbatore-641046, Tamilnadu, Mobile: +91-9443609873 Email: nivas_5@yahoo.com |
| Madurai Kamaraj (MK) University, Madurai | Dr. K. Anitha, Head (i/c), Department of Physics, Madurai Kamaraj University, Madurai-625021, Tamilnadu, Mobile: +91-9965956516; E-mail: anitha.physics@mkuniversity.org |
| IIT Madras, Chennai, Tamilnadu | Dr. P. K. Sudhadevi Antharjanam, Technical Officer, Contact Number: 91-44-22575939; Email: xrdsaifiitm@gmail.com |
| University of Jammu, Jammu, Tawi | Prof. Rajni Kant, Professor, PG & Department of Physics, University of Jammu, Jammu Tawi-180006, Mobile: +91-9419194375; Tel/Fax: +91-191-2432051; Email: rkant.ju@gmail.com |
| Cochin University of Science and Technology | CUST, Kerala http://www.sticindia.com/saif_instruments.html |
| Mahatma Gandhi (MG) University, Kerala | Prof. C. Sudarsankumar, Professor, School of Pure and Applied Physics, Mahatma Gandhi University, Kottyam-686560, Kerala, Mobile: +91-9447141561; Email: scxrdmgu@yahoo.com |
| **Powder X-Ray Diffraction (PXRD)** | |
| Alagappa University Karaikudi | Dr. K. Sankaranarayanan, Director – USIC. Mobile: +91-9865493229; hhrsankara@gmail.com Dr. Venkataraman Dharuman, Mobile: +91-9865679897; dharumanudhay@yahoo.com; |
| IIT Madras, Chennai Tamilnadu | Dr. P. K. Sudhadevi Antharjanam, Technical Officer, Phone Number: +91-44-22575939, Email: xrdsaifiitm@gmail.com |
| SRM University, Chennai | http://www.srmuniv.ac.in/content/characterization-form-and-charges |
| Sri Ramakrishna Engineering College | Department of Nanoscience & Technology, Sri Ramakrishna Engineering College, Coimbatore – 641022, Tamilnadu. Landline: +91-0422-2461588 (Extn:395); Email: nanofacilities@srec.ac.in |
| Cochin University of Science and Technology | CUST, Kerala http://www.sticindia.com/saif_instruments.html |
| Madurai Kamaraj (MK) University, Madurai | Dr. K. Anitha, Head (i/c), Department of Physics, Madurai Kamaraj University, Madurai-625021, Tamil Nadu, Mobile: +91-9965956516; E-mail: anitha.physics@mkuniversity.org |
| IISER, Mohali | Prof. Sanjay Mandal, Convener, X-ray Facility, Phone: +91-9779932606 IISER Mohali, Punjab-140306, Email: xrd@iisermohali.ac.in |
| Sastra University Thanjavur, Tamilnadu | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| Sathyabama University Chennai, Tamilnadu | http://centrefornanotechnology.com/facilities.html |
| Saurashtra University Rajkot, Gujarat | Dr. Mihir J. Joshi, Professor, Crystal growth Lab, Department of Physics, Saurashtra University, Rajkot-360005, Gujarat, Mobile: +91-90999399431; Email: mshilp24@rediffmail.com |
| Nirmalagiri College Nirmalagiri, Kerala | Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; nygill@gmail.com; sudheeshvd@gmail.com; vseba@yahoo.com; https://nygilt.nirmalagiricollege.ac. in/facilities |
| **UV-Vis NIR Analysis** | |
| Sacred Heart College Tirupattur, Tamilnadu | Dr. M. Jose, Dean of Research, Abraham Panampara Research Center (APRC), Sacred Heart College, Tirupattur, Phone: +91-9944825036; Email: jose@shctpt.edu |
| VIT University, Vellore, Tamilnadu | Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com |
| Pondicherry University, Pondicherry | Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility Phone: 0413-2654405(O) and 2654434; E-mail: ggraj_7@yahoo.com |
| Hindustan University, Chennai, Tamilnadu | Head, CENCON, Email: cencon@hindustanuniv.ac.in; https://hindustanuniv.ac.in/cencon.php |
| SRM University, Chennai, Tamilnadu | http://www.srmuniv.ac.in/content/characterization-form-and-charges |
| Sri Ramakrishna Engineering College | Department of Nanoscience & Technology, Sri Ramakrishna Engineering College, Coimbatore – 641022, Tamilnadu, Landline:+91-0422-2461588 (Extn: 395); Email: nanofacilities@srec.ac.in |
| St. Joseph College Tiruchirappalli | Dr .S. John Britto, Director http://www.sjctni.edu/Department/achome.jsp?deptCode=AC&id=1 |
| Sastra University Thanjavur, Tamilnadu | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |

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|---|---|
| Saurashtra University<br>Rajkot, Gujarat | Dr. Mihir J. Joshi, Professor, Department of Physics, Saurashtra University, Rajkot-360005,<br>Gujarat, Mobile: +91-90999399431; Email: mshilp24@rediffmail.com |
| Nirmalagiri College,<br>Nirmalagiri, Kerala | Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; nygill@gmail.com;<br>sudheeshvd@gmail.com; vseba@yahoo.com; https://nygilt.nirmalagiricollege.ac.in/facilities |
| **Fourier Transform Infrared (FTIR) Analysis** | |
| IIT Madras, Chennai | Dr. K. Paranjothi, Technical Officer, Email: kpjothi@iitm.ac.in |
| SRM University, Chennai,<br>Tamilnadu | http://www.srmuniv.ac.in/content/characterization-form-and-charges |
| Sacred Heart College,<br>Tirupattur, Tamilnadu | Dr. M. Jose, Dean of Research, Abraham Panampara Research Center (APRC),<br>Sacred Heart College, Tirupattur, Mobile: +91-9944825036; Email: jose@shctpt.edu |
| Loyola College, Chennai<br>Tamilnadu | Dr. S. Jerome Das, Department of Physics, Loyola College, Chennai, Tamilnadu<br>Mobile: +91-9381190314; Email: jeromedas.s@gmail.com |
| Sri Ramakrishna<br>Engineering College | Department of Nanoscience & Technology, Sri Ramakrishna Engineering College, Coimbatore –<br>641022, Tamilnadu, Landline:+91-0422-2461588 (Extn: 395); Email: nanofacilities@srec.ac.in |
| National College,<br>Tiruchirappalli | Dr. D. Saravanan, National College Instrumentation Facility (NCIF), National College, Trichy<br>E-mail: ncif@nct.ac.in; drdsaro@gmail.com; Web: http://www.nct.ac.in/ncif.html |
| St. Joseph College,<br>Tiruchirappalli | Dr. S. John Britto, Director<br>http://www.sjctni.edu/Department/achome.jsp?deptCode=AC&id=1 |
| Cochin University of<br>Science and Technology | Sophisticated Test & Instrumentation Centre, Cochin University of Science and Technology<br>Cochin-682022, Kerala, Web: http://www.sticindia.com/saif_instruments.html |
| SSN Research Centre,<br>SSN Institutions | Prof. P. Ramasamy, Dean (Research), SSN Institutions, Chennai-603110, Tamilnadu<br>Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in |
| Central University of<br>Tamil Nadu, Thiruvarur | Department of Physics, Central University of Tamil Nadu, Thiruvarur<br>http://cutn.ac.in/department-of-physics/facilities/ |
| Nirmalagiri College<br>Nirmalagiri, Kerala | Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; nygill@gmail.com;<br>sudheeshvd@gmail.com; vseba@yahoo.com; https://nygilt.nirmalagiricollege.ac. in/facilities |
| **TGA / STA / DSC/ DTA** | |
| IIT Madras, Chennai,<br>Tamilnadu | N.K. Gopinath, Junior Technical Superintendent, Phone Number: 91-44-22574933<br>Email: gopiphy@iitm.ac.in |
| Cochin University of<br>Science and Technology | Sophisticated Test & Instrumentation Centre, Cochin University of Science and Technology<br>Cochin-682022, Kerala, http://www.sticindia.com/saif_instruments.html |
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| Saurashtra University<br>Rajkot, Gujarat | Dr. Mihir J. Joshi, Professor, Department of Physics, Saurashtra University, Rajkot-360005,<br>Gujarat, Mobile: +91-90999399431; Email: mshilp24@rediffmail.com |
| Pondicherry University<br>Pondicherry | Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility<br>Phone: 0413-2654405 (O) & 2654434; E-mail: ggraj_7@yahoo.com |
| Loyola College, Chennai,<br>Tamilnadu | Dr. S. Jerome Das, Department of Physics, Loyola College, Chennai, Tamilnadu<br>Mobile: +91-9381190314; Email: jeromedas.s@gmail.com |
| Sastra University<br>Thanjavur, Tamilnadu | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| NPL<br>New Delhi | Head, NPLONE Program, CSIR-National Physical Laboratory (NPL), New Delhi-110012<br>Phone: 011-45608385; 45608396; Email: headnplone@nplindia.org |
| **Vickers Microhardness Analysis** | |
| St. Joseph College,<br>Tiruchirappalli | Dr. S. John Britto, Director, St. Joseph College, Tiruchirappalli, Tamilnadu<br>http://www.sjctni.edu/Department/achome.jsp?deptCode=AC&id=1 |
| National College,<br>Tiruchirappalli | Dr. D. Saravanan, National College Instrumentation Facility (NCIF), National College, Trichy<br>E-mail: ncif@nct.ac.in ; drdsaro@gmail.com; Web: http://www.nct.ac.in/ncif.html |
| Sastra University,<br>Thanjavur, Tamilnadu | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| University of Delhi,<br>Delhi | Dr. Binay Kumar, Professor, Crystal Lab, Department of Physics and Astro Physics, Delhi<br>Mobile: +91-9818168001; Email: b3kumar69@gmail.com |
| NPL,<br>New Delhi | Head, NPLONE Program, CSIR-National Physical Laboratory (NPL), New Delhi-110012<br>Phone: 011-45608385; 011-45608396; Email: headnplone@nplindia.org |

| Photoluminescence (PL) Study | |
|---|---|
| Pondicherry University Pondicherry | Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility Phone: 0413-2654405(Office) & 2654434, E-mail: ggraj_7@yahoo.com |
| Hindustan University Chennai, Tamilnadu | Head, CENCON, Email: cencon@hindustanuniv.ac.in; https://hindustanuniv.ac.in/cencon.php |
| Sastra University | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| IIT Madras, Chennai Tamilnadu | Dr. P. K. Sudhadevi Antharjanam, Technical Officer, Phone Number:+91-91-44-22575926 Email: lifesaifiitm@gmail.com |
| Sri Ramakrishna Engineering College | Department of Nanoscience & Technology, Sri Ramakrishna Engineering College, Coimbatore – 641022, Tamilnadu, Landline:+91-0422-2461588 (Extn:395); Email: nanofacilities@srec.ac.in |
| National College, Tiruchirappalli | Dr. D. Saravanan, National College Instrumentation Facility (NCIF), National College, Trichy E-mail: ncif@nct.ac.in; drdsaro@gmail.com; Web: http://www.nct.ac.in/ncif.html |
| B. S. Abdur Rahman Crescent University | Dr. G.V. Vijayarhagavan, Department of Physics, Mobile: +91-9790880065 Email: avvijay20@gmail.com http://www.bsauniv.ac.in/mode/faculty/action/list/department/10 |
| Nirmalagiri College, Nirmalagiri, Kerala | Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; Email: nygill@gmail.com; sudheeshvd@gmail.com; vseba@yahoo.com; https://nygilt.nirmalagiricollege.ac.in/facilities |
| **Powder Second Harmonic Generation (SHG) / NLO Measurement** | |
| IISc, Bangalore, Karnataka | Prof. P. K. Das, Department of Inorganic and Physical Chemistry, Indian Institute of Science (IISC), Bangalore, Karnataka, Email: pkdas@iisc.ac.in |
| B. S. Abdur Rahman Crescent University | Dr. G. V. Vijayarhagavan, Department of Physics, Mobile: +91-9790880065 Email: avvijay20@gmail.com http://www.bsauniv.ac.in/mode/faculty/action/list/department/10 |
| Baba Amravati University, Maharastra | Dr. Gajanan G. Muley, Department of Physics, Baba Amravati University, Maharastra Mobile: +91-9850325379; Email: gajananggm@yahoo.co.in |
| **Z-Scan / Third Harmonic Generation (THG) Measurement** | |
| VIT University, Vellore Tamilnadu | Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com |
| VIT University, Chennai Tamilnadu | Dr. G. Vinitha, Division of Physics, School of Advanced Sciences, Vellore Institute of Technology (VIT), Chennai-600127, Mobile: +91-9445601869; Email: vinitha.g@vit.ac.in |
| Baba Amravati University, Maharastra | Dr. Gajanan G. Muley, Department of Physics, Baba Amravati University, Maharastra Mobile: +91-9850325379; Email: gajananggm@yahoo.co.in |
| **Laser Damage Threshold (LDT) Analysis** | |
| VIT University, Vellore Tamilnadu | Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com |
| Baba Amravati University, Maharastra | Dr. Gajanan G. Muley, Department of Physics, Baba Amravati University, Maharastra Mobile: +91-9850325379, Email: gajananggm@yahoo.co.in |
| B. S. Abdur Rahman Crescent University | Dr. G.V. Vijayarhagavan, Department of Physics, Mobile: +91-9790880065 Email: avvijay20@gmail.com http://www.bsauniv.ac.in/mode/faculty/action/list/department/10 |
| **Chemical Etching/ Optical Microscope** | |
| VIT University, Vellore Tamilnadu | Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com |
| St. Joseph College, Tiruchirappalli | Dr. S. John Britto, Director, St. Joseph College, Tiruchirappalli, Tamilnadu http://www.sjctni.edu/Department/achome.jsp?deptCode=AC&id=1 |
| SSN Research Centre, SSN Institutions | Prof. P. Ramasamy, Dean (Research), SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in |
| **Nuclear Magnetic Resonance (NMR) Analysis** | |
| IIT Madras, Chennai Tamilnadu | Dr. C. Baby, Technical Officer, Email: cbaby@iitm.ac.in Phone Number: 91-44-22574944/4939/4917 |
| Pondicherry University Pondicherry | Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility Phone: 0413-2654405 (O) & 2654434; E-mail: ggraj_7@yahoo.com |
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| Sastra University | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| Cochin Univ. of Science & Technology, Kerala | Sophisticated Test & Instrumentation Centre, Cochin University of Science and Technology Cochin-682022, Kerala, http://www.sticindia.com/saif_instruments.html |

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|---|---|
| **Dielectrics/ Impedance Analyser/ LCR meter Analysis** | |
| VIT University, Vellore Tamilnadu | Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com |
| St. Joseph College Tiruchirappalli | Dr. S. John Britto, Director, St. Joseph College, Tiruchirappalli, Tamilnadu http://www.sjctni.edu/Department/achome.jsp?deptCode=AC&id=1 |
| Loyola College Chennai | Dr. S. Jerome Das, Department of Physics, Loyola College, Chennai, Tamilnadu Mobile: +91-9381190314; Email: jeromedas.s@gmail.com |
| University of Delhi Delhi | Dr. Binay Kumar, Professor, Crystal Lab, Department of Physics and Astro Physics, University of Delhi, Mobile: +91-9818168001; Email: b3kumar69@gmail.com |
| Sacred Heart College Tirupattur | Dr. M. Jose, Dean of Research, Abraham Panampara Research Center (APRC), Sacred Heart College, Tirupattur, Mobile: +91-9944825036; Email: jose@shctpt.edu |
| Nirmalagiri College Kerala | Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; nygill@gmail.com; sudheeshvd@gmail.com; vseba@yahoo.com; https://nygilt.nirmalagiricollege.ac. in/facilities |
| Saurashtra University Rajkot | Dr. Mihir J. Joshi, Professor, Crystal growth Lab, Department of Physics, Saurashtra University, Rajkot-360005, Gujarat, Mobile: +91-90999399431; Email: mshilp24@rediffmail.com |
| **Macro, Micro-Raman/ FT-Raman/ Raman Studies** | |
| IIT Madras, Chennai Tamilnadu | Dr. K. Paranjothi, Technical Officer, IIT Madras, Chennai, Tamilnadu Phone Number: +91-44-22574942, Email: kpjothi@iitm.ac.in |
| Madurai Kamaraj (MK) University, Madurai | Dr. K. Anitha, Department of Physics, Madurai Kamaraj (MK) University, Madurai-625021, Tamil Nadu, Mobile: +91-9965956516; E-mail: anitha.physics@mkuniversity.org |
| NPL New Delhi | Head, NPLONE Program, CSIR-National Physical Laboratory (NPL), New Delhi-110012, Phone: +91-011-45608385; 45608396; Email: headnplone@nplindia.org |
| **Hall Measurement** | |
| SRM University Chennai | http://www.srmuniv.ac.in/content/characterization-form-and-charges |
| Hindustan University Chennai | Head, CENCON, Email: cencon@hindustanuniv.ac.in; https://hindustanuniv.ac.in/cencon.php |
| Sastra University Thanjavur | http://www.sastra.edu/index.php/2014-01-29-07-16-29/central-facilities.html |
| University of Delhi Delhi | Dr. Binay Kumar, Professor, Crystal Lab, Department of Physics & Astro Physics, University of Delhi Mobile: +91-9818168001; Email: b3kumar69@gmail.com |
| **Pyroelectric Co-Efficient Analysis** | |
| University of Delhi Delhi | Dr. Binay Kumar, Professor, Crystal Lab, Department of Physics & Astro Physics, University of Delhi Mobile: +91-9818168001; Email: b3kumar69@gmail.com |
| **Piezoelectric $d_{33}$ Co-efficient Analysis** | |
| University of Delhi Delhi | Dr. Binay Kumar, Professor, Crystal Lab, Department of Physics & Astro Physics, University of Delhi Mobile: +91-9818168001; Email: b3kumar69@gmail.com |
| SSN Research Centre SSN Institutions | Prof. P. Ramasamy, Dean (Research), SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in |
| **Photo Acoustic (PA) Spectrum** | |
| Sacred Heart College Tirupattur | Dr. S.A. Martin Britto Dhas, Department of Physics, Sacred Heart College, Tirupattur Vellore-635601, Tamil Nadu, Mobile: +91-8903101253; Email: britto25@gmail.com |
| SSN Research Centre SSN Institutions | Prof. P. Ramasamy, Dean (Research), SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in |
| **High Resolution X-Ray Diffraction (HRXRD) Analysis** | |
| NPL New Delhi | Head, NPLONE Program, CSIR-National Physical Laboratory (NPL), New Delhi-110012 Phone Number: +91-011-45608385; 45608396; Email: headnplone@nplindia.org |
| UGC-DAE CSR Indore, MP | The Centre-Director, UGC-DAE Consortium for Scientific Research, Indore Centre, University Campus, Khandwa Road, Indore-452001, Madhya Pradesh, Email: cd.indore@csr.res.in |
| **Photoconductivity Measurement** | |
| Central University of Tamil Nadu | Department of Physics, http://cutn.ac.in/department-of-physics/facilities/ Department of Chemistry, http://cutn.ac.in/department-of-chemistry/ |
| SSN Research Centre SSN Institutions | Prof. P. Ramasamy, Dean (Research), SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in |

# Ph.D. Theses in Crystal Growth (2017)

| S.No | Name of the students | Title of the thesis | Supervisor & Affiliation |
|---|---|---|---|
| 1 | Alexandar. A | Synthesis, growth and characterization of amino acid based LMP, NT, LLPNP, LTN and LAMD single crystals for II & III order NLO and its biological applications | Dr. P. Rameshkumar<br>Periyar E.V.R College (A)<br>Tiruchirappalli-620023 |
| 2 | Amuthambigai. C | Growth and characterization of some semi-organic crystals for optical applications | Dr. X. Sahaya Shajan<br>PSN College of Engineering<br>Technology, Tirunelveli-627152 |
| 3 | Angelena. J. P | Studies on solution grown and SR grown crystals of glycinium oxalate, bis-glycine cadmium chloride, tris-glycine zinc chloride and L-proline cadmium chloride | Dr. S. Jerome Das<br>Loyola College<br>Chennai-600034 |
| 4 | Arul. H | Investigations on growth, characterization and effects of ion implantation on organic and semi-organic single crystals for NLO applications | Dr. D. Rajan Babu<br>School of Advanced Sciences<br>VIT University, Vellore-632014 |
| 5 | Babu Rao. G | Growth of direction controlled KAP single crystals and influence of dyes on their growth and properties | Dr. P. Rajesh<br>SSN College of Engineering<br>Chennai-603110 |
| 6 | Chennakrishnan. S | Synthesis, growth and physicochemical properties of amino acid based semi-organic NLO crystals: LLMHC, TGBC, LGAZC AND L-LYSINE doped TGBC | Dr. S. M. Ravi Kumar<br>Government Arts College<br>Tiruvannamalai-606603 |
| 7 | Dinagaran. S | Investigations on the growth and properties of some organic single crystals for nonlinear optical applications | Dr. P. Srinivasan<br>University College of Engineering<br>Panruti, Panruti-607106 |
| 8 | Giri Dhari Patra | Single crystal growth of lithium tetra borate and its characterization as a multi-functional material for personal dosimetry | Dr. S. C. Gadkari<br>Technical Physics Division<br>BARC, Mumbai-400085 |
| 9 | Geetha. P | Computational and spectroscopic studies on L-iso Leucine based non-centrosymmetric single crystals | Dr. J. Madhavan<br>Loyola College<br>Chennai-600034 |
| 10 | Harsh Yadav | Morphological, optical and dielectric studies of piezoelectric crystals grown by solution and modified Czochralski techniques for patch antenna fabrication | Prof. Binay Kumar<br>University of Delhi<br>Delhi-110021 |
| 11 | Jauhar. Ro. Mu | Investigations on the supramolecular assemblies of pyridine based organic crystals for nonlinear optical (NLO) applications | Dr. P. Murugakoothan<br>Department of Physics<br>Pachaiyapp's College, Chennai-30 |
| 12 | Jaikumar. P | Investigation on the growth and characterization of some organic and semi-organic single crystals | Dr. T. Balakrishnan<br>Periyar E.V.R College (A)<br>Tiruchirappalli-620023 |
| 13 | Jayanalina. T | Synthesis, structure, growth and characterization of 2-Amino 5 -Chloropyridine derivative crystals for nonlinear optical applications | Dr. G. Rajarajan<br>PGP Educational Institutions<br>Namakkal-637207 |
| 14 | Jyoti | Growth of piezoelectric non-linear optical organic/semi organic single crystals and their structural, optical, thermal and dielectric characterizations | Prof. Binay Kumar<br>University of Delhi<br>Delhi-110021 |
| 15 | Kalaivanan. R | Synthesis, growth and characterization of N-benzyl-2-methyl-4-nitroaniline (BNA) and Potassium dihydrogen phosphate (KDP) single crystals from solutions with different chemical environments for nonlinear optical applications | Dr. K. Srinivasan<br>Department of Physics<br>Bharathiar University<br>Coimbatore-641046 |
| 16 | Kanika Thukral | Study of L-Proline based single crystals for nonlinear optical Applications | Dr. N. Vijayan<br>CSIR-NPL<br>New Delhi-110012 |
| 17 | Kathiravan. P | Synthesis, crystal growth and characterization of some amino acid family of single crystal | Dr. T. Balakrishnan<br>Periyar E.V.R College(A)<br>Tiruchirappalli-620023 |
| 18 | Krishnakumar. M | Synthesis, crystal growth and characterization of certain benzoate, L-tartrate and glutarate based organic nonlinear optical materials | Dr. S. Brahadeeswaran<br>BIT-Anna University<br>Tiruchirappalli-620024 |
| 19 | Latha Mageshwari. P.S | Investigation on third order NLO active SHS, SSH and second order NLO active LSM single crystals | Dr. S. Jerome Das<br>Loyola College, Chennai-600034 |

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| 20 | Muthupoongodi. S | Radiation effects on the physico-chemical properties of pure and doped strontium formate dihydrate crystals | Dr. X. Sahaya Shajan<br>PSN College of Engineering Technology,<br>Tirunelveli-627152 |
| 21 | Nallamuthu. S | Magnetic, thermodynamic and transport properties of R- T-X (R = La-Gd; T = Co, Ni, Cu, Rh And Ag; X = Si, Ga And Al) type intermetallic compounds | Dr. R. Nagalakshmi<br>Department of Physics<br>NIT, Trichy-620015 |
| 22 | Niranjana. S. R | Linear and nonlinear optical properties of some organic single crystals | Dr. J. Madhavan<br>Loyola College<br>Chennai-600034 |
| 23 | Ramya. K | Studies on the characterization of some amino acid and dicarboxylic acid based crystals grown from liquid diffusion technique | Dr. C. Ramachandra Raja<br>Department of Physics<br>Government Arts College (A)<br>Kumbakonam-612002 |
| 24 | Rafi Ahamed. S | Studies on the structural and physico chemical properties of some organic nonlinear optical crystals | Dr. P. Srinivasan<br>University College of Engineering Panruti, Panruti-607106 |
| 25 | Rashid. T.P | Magnetocaloric properties of gadolinium and dysprosium based alloys for wide temperature range magnetic refrigeration | Dr. R. Nagalakshmi<br>Department of Physics<br>NIT, Trichy-620015 |
| 26 | Sagunthala. P | Physicochemical characterization of sulphates of Zn, Cu and Ni crystals upon the addition of certain amino acids and an exploration on their application domain | Dr. V. Veeravazhuthi<br>PSG College of Arts And Science<br>Coimbatore-641014 |
| 27 | Satchidanandham .P | Synthesis, crystal growth and characterization of certain Aminopyridine based organic nonlinear optical (NLO) materials | Dr. S. Brahadeeswaran<br>Bharathidasan Institute of Technology (BIT),<br>Tiruchirappalli-620024 |
| 28 | Sathesh Kumar. K | Studies on the structural and physico chemical properties of some organic nonlinear optical crystals | Dr. P. Srinivasan<br>University College of Engineering Panruti, Panruti-607106 |
| 29 | Sathish Kumar. S | Synthesis, crystal growth and characterization of some metal complexes of L-Proline | Dr. T. Balakrishnan<br>Periyar E.V.R College (A)<br>Tiruchirappalli-620023 |
| 30 | Senthil Kumar. C | Nucleation kinetics, growth, structural, optical and dielectric studies of Dicarboxylic Acid based semi-organic single crystals | Dr. P. Rajesh<br>SSN College of Engineering<br>Chennai-603110 |
| 31 | Silambarasan. A | Investigation on nucleation kinetics and bulk growth of inversely soluble single crystals for NLO and Pyroelectric applications | Dr. P. Rajesh<br>SSN College of Engineering<br>Chennai-603110 |
| 32 | Siva Balan Solanki. S | Growth and characterization of organic single crystals by low temperature vertical Bridgman technique | Dr. N. P. Rajesh<br>SSN College of Engineering<br>Chennai-603110 |
| 33 | Sushil Kumar Sharma | Growth and characterization of KDP, LAP and ZCTC crystals for non-linear optical applications | Dr. K. S. Bartwal<br>Solution Crystal Growth Lab<br>Laser Materials Section<br>RRCAT, Indore-452013, M. P. |
| 34 | Sritharan. K | Growth of bulk single crystals of methyl p-hydroxybenzoate (p-MHB) and Ammonium dihydrogen Phosphate (ADP) through various crystal growth methods and their characterizations for nonlinear optical applications | Dr. K. Srinivasan<br>Department of Physics<br>Bharathiar University<br>Coimbatore-641046 |
| 35 | Subramanian. M | Synthesis, growth and characterization of inorganic and organic single crystals by high temperature and low temperature solution growth method | Dr. G. Anandha Babu<br>SSN College of Engineering<br>Chennai-603110 |
| 36 | Thilagavathi. R | Growth and characterization of some glycine based crystals | Dr. P. Selvarajan<br>Aditanar College of Arts and Science, Tiruchendur-628216 |
| 37 | Vasantha Kumari. V | Growth and studies of some L-proline compound crystals | Dr. P. Selvarajan<br>Aditanar College of Arts and Science, Tiruchendur-628216 |
| 38 | Vijayakumar. S | Growth and characterization of some aromatic halo nitro derivative based nonlinear optical (NLO) crystals | Dr. P. Srinivasan<br>University College of Engineering Panruti, Panruti-607106 |

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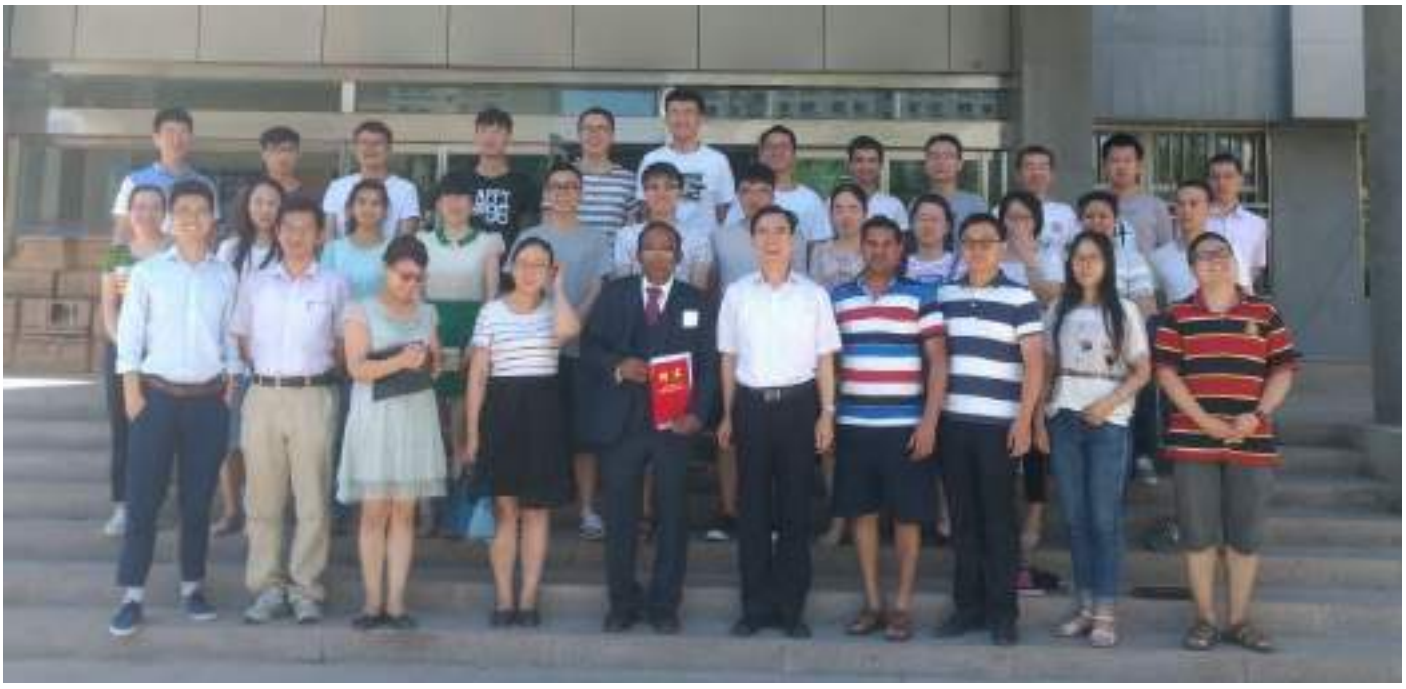


**Prof. P. Ramasamy** with **Prof. Shilie Pan** and his colleagues and students in Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China on October 2017

**Dr. K. Sethuraman**, Madurai Kamaraj University, Madurai at Materials Research Society (MRS) Spring Meeting held at Phoenix, USA during 17-21th April 2017

**Prof. C. K. Mahadevan**, PSN College of Engineering & Technology, Tirunelveli visited Changchun University of Science and Technology, China during 25th September to 18th October 2017

**Dr. K. Tirupugalmani,** C/o Dr. S. Brahadeeswaran, Head, Department of Physics, BIT-Anna University, Tiruchirappalli got Post Doctoral Fellowship (PDF) in Key Laboratory of Photonics Materials and Technology, College of Physics, Qingdao University, China. He will be working in several NLO crystals for terahertz applications.

**Dr. M. Esthaku Peter,** C/o Prof. P. Ramasamy, Dean (Research), SSN Institutions, Chennai is working as a Faculty in Department of Physics, Dilla University, Dilla, Ethiopia. He built Crystal Growth Laboratory in his department. He is growing several organic nonlinear optical (NLO) and ferroelectric single crystals.

**Dr. K. Ramchandra Rao**, Raman Post Doctoral Fellow and Director, Crystal Growth and Nanoscience Research Centre, Department of Physics, Government College (A), Rajamahendravaram, Andhra Pradesh with Dr. Jacek, Theme Leader, Conn Center for Renewable Energy Research Center, University of Louisville, USA during March 2017

**Prof. S. Kalainathan,**
Director, Centre for Crystal Growth, VIT University, Vellore, Tamilnadu visited the following countries and delivered lectures.

1. **Invited Talk** during the visit of Australian National University , ***Australia*** as Honorary Professor .

2. **Plenary talk** in the Eighth International Conference on Materials Engineering for Resources (ICMR-2017) during 25-25th October 2017 organized by Akita University, ***Japan***.

3. **Invited Talk** in IEEE Magnetics Society Sendai/Sapporo Joint Chapter, IEEE Sendai Section, ***Japan***.

4. **Invited Talk** in Cambridge Summit 2018 organized by VIT held in University of Cambridge, ***UK*** during 4-6th January 2018

**Dr. A. T. Ravichandran** , Associate Professor, Department of Physics, National College (A), Tiruchirappalli presented a paper in 7th International Workshop on Crystal Growth Technology (IWCGT-2017) held at Potsdam, Berlin, Germany during 2-6th July 2017

**Prof. SP. Meenakshisundaram** presented a paper in the 21st ACCGE-2017 held at New Mexico during 30thJuly to 4th August 2017

# YOUNG / SENIOR RESEARCHERS FORUM

**Prof. P. Ramasamy** received the indigenously developed Photoacoustic Spectrometer from **Dr. S. A. Martin Britto Dhas**, Sacred Heart College

**Prof. B. S. Shah** has visited Crystal Growth Lab, Department of Physics, Saurastra University. He was a Ph.D. Supervisor of **Prof. Mihir. J. Joshi**

## TNSCST – Young Scientist Award

**Dr. S. A. Martin Britto Dhas**, Assistant Professor, Department Physics, Sacred Heart College, Tirupattur received Young Scientist Award from TNSCST. He was working with Prof.S.Asohan, Instrumentation & Applied Physics Department, IISc, Bangalore during April to June 2017.

## Appointed as Scientist in NPL

**Dr. Anuj Krishna** is doing Ph.D. in crystal growth by solution and met techniques under the guidance of Dr. N. Vijayan, Senior Scientist, NPL. He is appointed as a Scientist-C in X-Ray Analysis and Crystal Growth Section, CSIR-National Physical Laboratory (NPL), New Delhi.

## Elected as a Vice-Chairman, MRSI

**Dr. S. Brahadeeswaran**, Head, Department of Physics, BIT-Anna University, Tiruchirappalli elected as a Vice-Chairman for Materials Research Society of India (MRSI)- Trichy Chapter, Tamilnadu on March 2017.

## Appreciation from the Management

**Dr. R. Arun Kumar,** Associate Professor, GRD Centre for Materials Research, PSG College of Technology, Coimbatore received appreciation from the Management and Principal for his Outstanding Institute – Industry Interaction activities in the academic year 2017.

## International Fellowship

**Mr. Kirtan P Dixit**, C/o Prof. Mihir. J. Joshi, Department of Physics, Saurashtra University, Rajkot, Gujarat joined in Ohio University, Athens, Ohio, USA for his Ph.D. He has grown several NLO single crystals by solution method.

## Associate Editor in JFMBM

**Dr. N. Vijayan,** Senior Scientist, X-Ray Analysis and Crystal Growth Section NPL, New Delhi has appointed as the Associate Editor, Journal of Functional Materials and Bio Molecules managed by Department of Physics, Sacred Heart College, Tirupattur.

**Prof. S. C. Gadkari**, Outstanding Scientist and Head, TPD, BARC visited **Prof. Mihir. J. Joshi's** Lab in Saurashtra University, Rajkot during July 2017

**Dr. R. Arun Kumar**, PSG College of Tech. receiving Appreciation Certificate for his Outstanding Institute – Industry Interaction Activities in the year 2017

## Indian National Science Academy (INSA) Fellowships

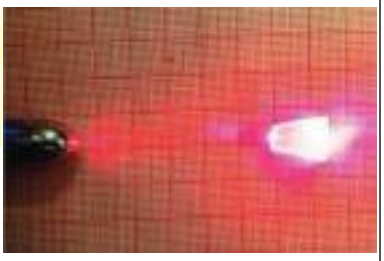
**Dr. P. Rajesh**, Assistant Professor, Department of Physics, SSN College of Engineering, Chennai was selected for INSA - Summer Research Fellowship-2017. He was working with Prof. K. K. Maurya, Principal Scientist, Sophisticated Analytical Equipment Division CSIR-National Physical Laboratory (NPL), New Delhi during 15th May to 15th July 2017.

**Dr. K. Anitha**, Assistant Professor, Department of Physics, Madurai Kamaraj University (MKU), Madurai was selected for INSA-Visiting Scientist Fellowship-2017. She was working in SSN Research Centre, SSN Institutions, Chennai during September to October 2017. She was working in several nonlinear optical single crystals by conventional slow evaporation and SR method.

## MoU: GRD Centre for Materials Research, PSG Tech. & Indfurr Industry

**Dr. R. Arun Kumar** is working as Centre Head and Associate Professor, GRD Centre for Materials Research, PSG College of Technology, Coimbatore, Tamilnadu. MoU signed between GRD Centre for Materials Research, PSG College of Technology and M/s. Indfurr Industries, Chennai, to developed sophisticated lab equipment for growing technologically important single crystals.

## MoU: Govt. College (A), Rajamundry & CCRER, University of Louisville, USA



MoU signed between Crystal Growth and Nanoscience Research Centre, Department of Physics, Government College (A), Rajamahendravaram, Andhra Pradesh (A.P.) and Conn Centre for Renewable Energy Research, University of Louisville, USA to develop new phosphors crystalline materials. The centre is working on Light Emitting Phosphors crystalline materials for various kind of display and LED applications. Also CGNSRC research is under progress on single crystals for Second Harmonic Generation properties for electro-optical modulator (EOM) and other optical applications.

## Crystal Growers get Best Paper Awards in DAE - Solid State Physics Symposium (SSPS-2017), 26-30th December 2017, BARC, Mumbai

**Dr. K. BOOPATHI**
NPDF, Crystal Growth Centre
Anna University
Chennai-600025, TN

**T. KAMALESH**
Junior Research Fellow
SSN RC, SSN Institutions
Chennai-603110, TN

**M. LOGU**
CSIR-Senior Research Fellow
Madurai Kamaraj University
Madurai-625021, TN

## NASI - Young Scientist Platinum Jubilee Award

**Dr. Mohit Tyagi**, Scientific Officer-F, Technical Physics Division (TPD), BARC, Mumbai received **"NASI Young Scientist Platinum Jubilee-2017" in Physical Sciences** held at the National Academy of Sciences, Uttar Pradesh (U.P.), India.

## Young Scientist Award

**Dr. G. Vinitha**, Assistant Professor, School of Advanced Sciences, VIT University, Chennai received **"IOSRD – Young Scientist Award-2017"** for her outstanding research in Crystal Growth and Materials Science. This programme was organized by IOSRD during 29-30th December 2017 at Chennai.

## DST - Women Scientist Award

**Dr. S. Boomadevi**
Woman Scientist (DST)
Department of Physics
National Institute of Technology – Trichy (NITT)
Tamilnadu

**Dr. S. Boomadevi** received **DST – Women Scientist Award-2017** and the below mentioned Crystal Growth project has been approved by Department Science and Technology (DST) for the scheme WOS-A.

**Project Title:** Growth and Characterization of high quality organic DAT-2, HMQ-TMS and OHQ-T crystals for efficient broad band terahertz generation.

**Duration & Budget :** 3 Years & 24.0 lakh

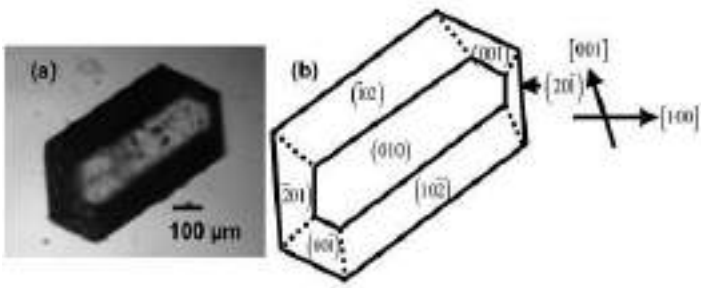
## Outstanding Researcher Award


**Dr. N. Vijayan**, Senior Scientist, X-Ray Analysis and Crystal Growth Section, CSIR - National Physical Laboratory (NPL), New Delhi received **Outstanding Researcher Award-2017** for his outstanding research in Crystal Growth from Jupiter Organization held at Liberty Park Hotel, Chennai, Tamilnadu during 22nd July 2017.

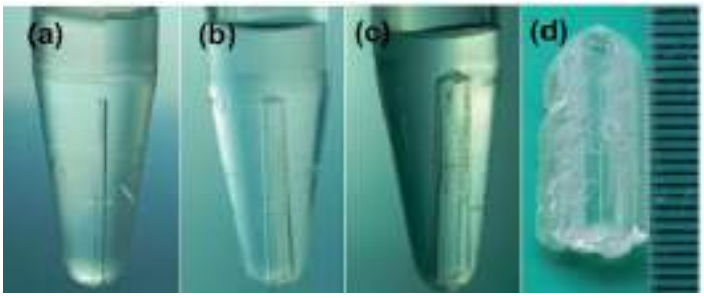
# Effect of liquid - liquid phase separation (LLPS) on nucleation and different growth stages of vanillin and bulk growth of defect-free vanillin single crystals from aqueous solution – a new approach

**P. Parimaladevi, C. Kavitha, K. Srinivasan***
Crystal Growth Laboratory, Department of Physics, School of Physical Sciences,
Bharathiar University, Coimbatore-641046, Tamil Nadu, India

Liquid – Liquid Phase Separation (LLPS) occurring in the saturated aqueous solution of vanillin greatly affects the nucleation, growth and optical quality of the crystals. Temperature, concentration, stirring and aging of the solution play key roles in controlling the occurrence of LLPS. The MSZW of vanillin aqueous solution and the bulk growth of defect-free vanillin single crystals in aqueous solution have been reported for the first time. The crystals grown by a slow cooling method involved four different growth stages and lost their transparency due to the inclusion of oil droplets in the preferred orientation of the growth units. The traditional approaches, slow evaporation and slow cooling (saturation at higher temperature), are not successful in suppressing the occurrence of LLPS and in the growth of transparent single crystals.




*(a) Microscopic image of a vanillin single crystal grown by slow cooling and (b) its schematic morphology*




*Various growth steps of the vanillin crystal (a) seed crystal (b) after 21 days, (c) after 35 days & (d) after harvest*

A new method proposed in this work is a promising one to eliminate the effect of oil on the growth surfaces of vanillin crystals in aqueous solution. So far, bulk single crystal of vanillin with dimensions of about 2.1 cm × 0.9 cm × 0.1 cm was not grown by any of the techniques and methods reported in the existing literature. Additional advantages of this new method are that it is easy to perform at room temperature, requires only a small volume of the solution and is very economical since it has no need for sophisticated instruments. The characterization results of the grown crystals indicate that both the deformed mass of aggregation and transparent crystals grown by slow cooling and controlled evaporation are pure in their crystalline and chemical nature. The leafy spike-like dendrites are formed only by the movement of oil droplets throughout the solution during growth of the facets and terraces and not by the inclusion of foreign impurities. These results also indicate that there is no undesirable chemical reaction ( i.e. contamination during processing) that takes place between the solute and solvent during crystallization of vanillin crystals from aqueous solution. By seeding at lower supersaturation and lower temperature using a lower volume of solution in this new approach, we were able to grow defect-free bulk vanillin single crystals from aqueous solution.


*Growth progression of a vanillin single crystal in water without seed rotation by slow cooling: (a) the seed crystal, (b) growth of the seed with transparency and perfect morphology, (c) re-dissolution of the edges and oil entrapment in the center of the growing crystal, (d) terrace formation, (e) surface nucleation of leafy spike-like dendrites at the bottom and at the top, and (f) grown leafy spike-like dendrites at the end of the experiment*

**Reference**

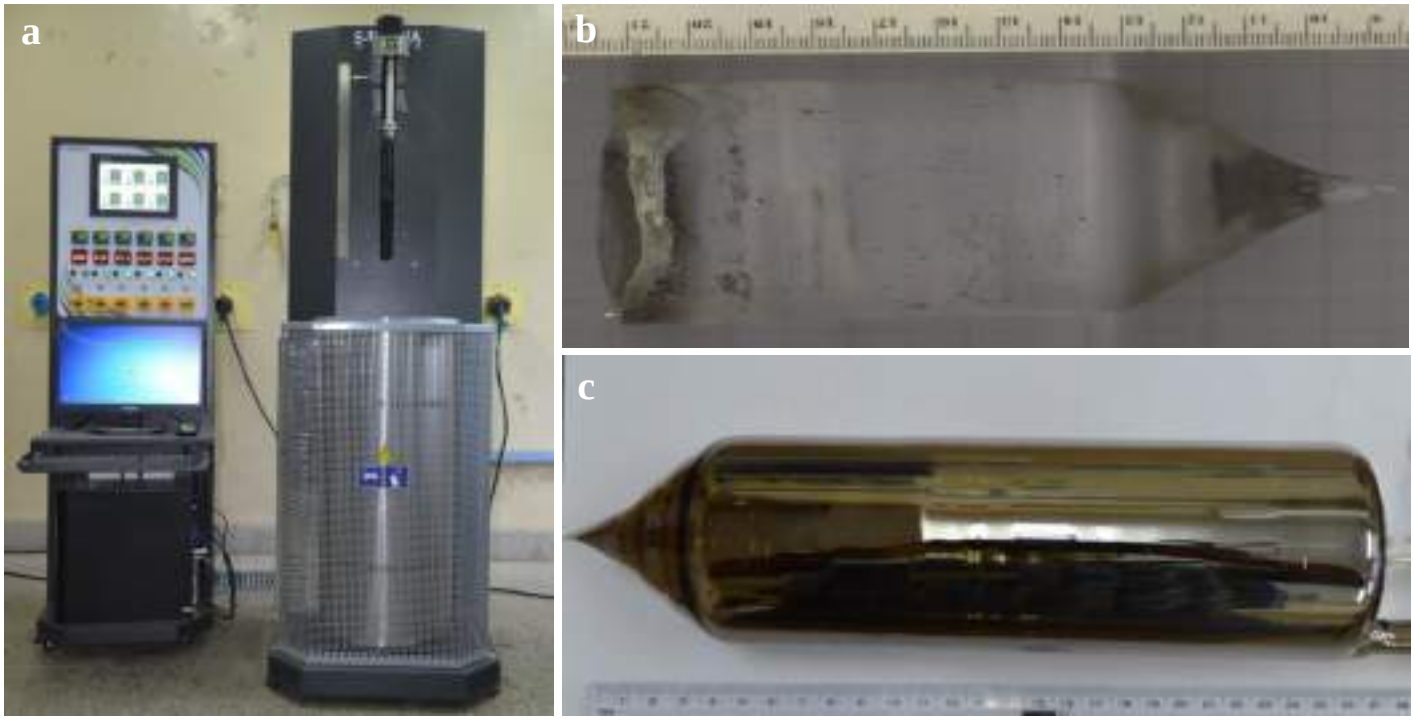
[1] P. Parimaladevi, C. Kavitha, K. Srinivasan, Cryst. Engg. Comm. 16 (2014) 2565-2569.

# Bulk growth of CSI:Tl, $Gd_3Ga_3Al_2O_{12}$:Ce (GGAG) and Ge single crystals by melt techniques

**S.C. Gadkari**
Crystal Technology Section, Technical Physics Division, BARC, Mumbai-400085, India

## CSI:Tl crystals

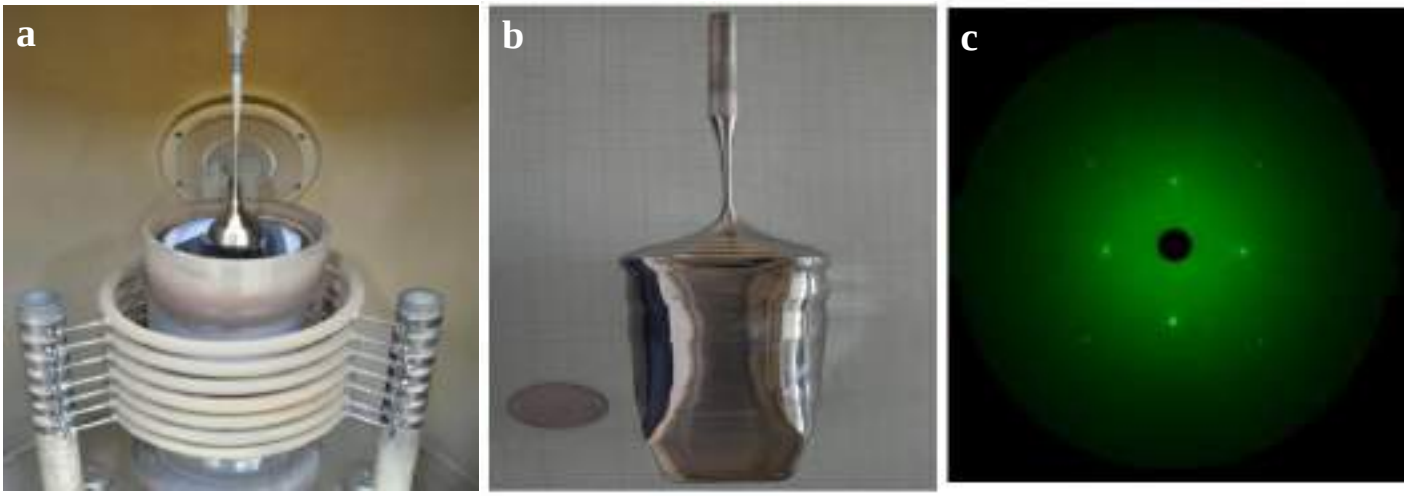
Large size CsI:Tl single crystals are grown using the Bridgman Technique to be supplied to various users for radiation detection. The crystals are grown in an indigenously designed and developed Bridgman system. The system has been fabricated involving local industry. It is controlled through a computer and has automatic rotation and lowering mechanisms and the furnace has independently controlled six heating zones. The growth is carried out in carbon coated silica crucibles.




*(a) The Bridgman crystal growth system designed and developed involving local industry. (b) Grown CsI:Tl crystal (Wt: about 1500 g, diameter 65 mm, length ~80 mm). (c) A technique has been developed to coat internal surface of large quartz crucibles for the growth of alkali-halide crystals.*

## Growth of Ge crystals

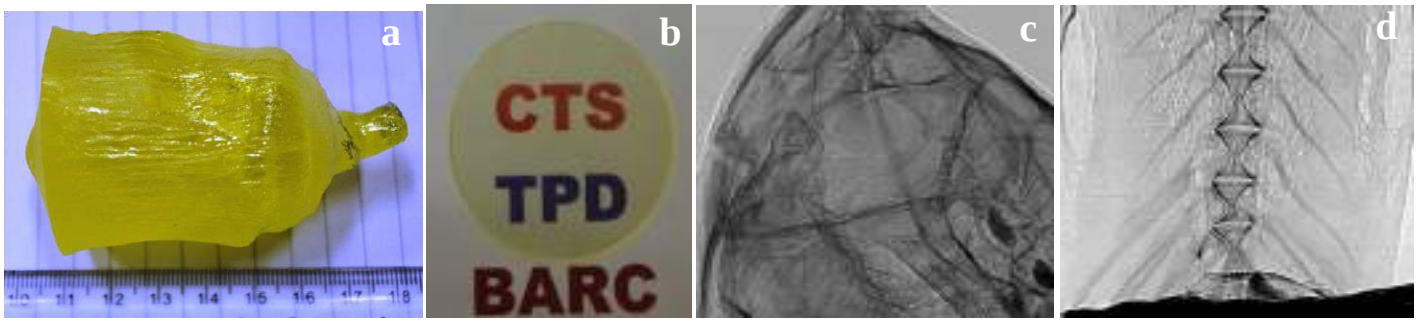
Ge crystals are grown by CZ technique using starting charge of 9N purity. Weight of the crystal: ~950 g .




*(a, b) Ge single crystal grown in CZ furnace. (c) The Laue pattern of the bottom face of Ge crystal confirmed the Four-fold symmetry of (100) orientation*

## Single crystals of $Gd_3Ga_3Al_2O_{12}$:Ce (GGAG) grown by Czochralski Technique

$Gd_3Ga_3Al_2O_{12}$:Ce (GGAG) is a fast scintillator. The crystals have been grown using the CZ technique cut and polished at BARC. The disc of diameter 30 mm and thickness around 150 mm is used for the X-Tomography at synchrotron beamline at RRCAT. A spatial resolution of about 3 μm is achieved with this crystal which is comparable to commercially available YAG crystals.




*(a) $Gd_3Ga_3Al_2O_{12}$:Ce (GGAG) crystal (Wt: 528 g) grown using the Czocharlski technique. (b) GGAG:Ce crystal disc (diameter 30 mm, thickness ~150 micron) for use in an X-ray camera for micro-tomography. (c & d) Images of a zebra fish recorded at the Imaging beam line at RRCAT, Indore using an X-ray camera developed with GGAG:Ce crystal*

# Compact electro-optic modulator fabricated using KDP element obtained from crystal grown by solute-feed based unidirectional technique

**S. K. Sharma, V. Sachin*, Yeshpal Singh, Sunil Verma, K. S. Bartwal, A. K. Karnal**
Solution Crystal Growth Laboratory, Laser Materials Section,
Raja Ramanna Centre for Advanced Technology, Indore-452013, Madhya Pradesh (M.P.)
*Department Optoelectronics, University of Kerala, Thiruvananthapuram-695034, Kerala

A compact electro-optic modulator has been designed and fabricated using KDP crystal grown by solute feed based unidirectional technique. The crystal element was AR coated at the central region to reduce reflection losses and the peripheral region was gold coated to apply electric field.[1] The half wave voltage measured using He-Ne laser (632.8 nm) of the fabricated electro-optic modulator was 9.1 kV which is in good agreement with the calculated theoretical value.

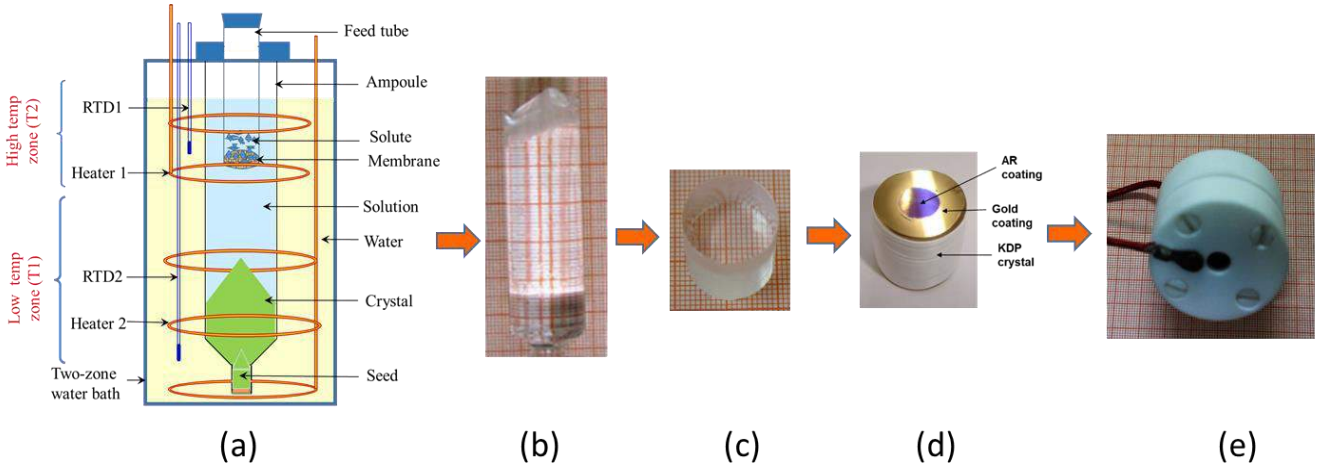



*Fig (a) Schematic of solute feed unidirectional growth apparatus, (b) KDP grown along [001] direction, (c) cut and polished element, (d) AR coated and conducting coating (electrodes) at the ends of element and (e) fabricated longitudinal electro-optic modulator.*

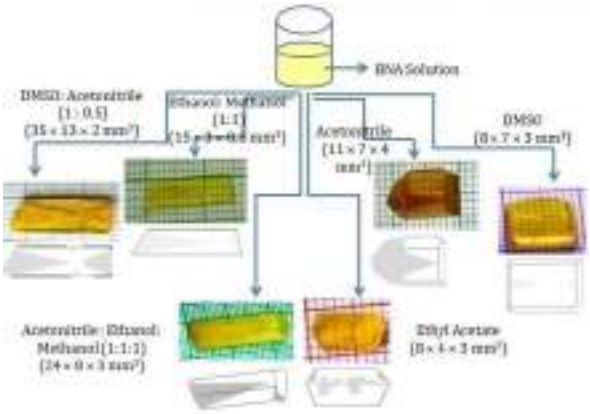
**Reference**

[1] S.K. Sharma, Sachin V, Yeshpal Singh, R. Kamparath, C. Mukherjee, Sunil Verma, K.S. Bartwal, A.K. Karnal, DAE-BRNS National Laser Symposium-26, December 20-23, 2017, BARC, Mumbai. pp. 40-41.

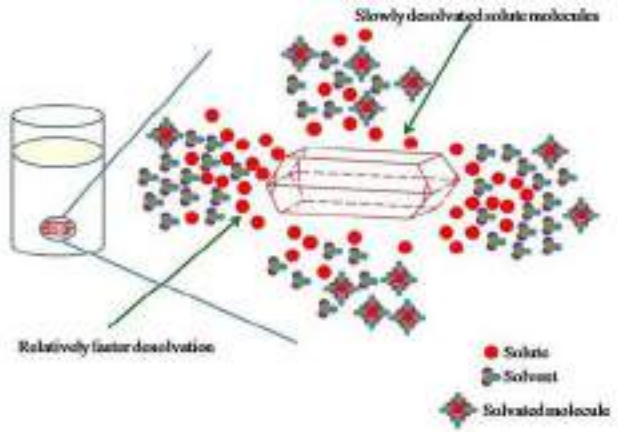
# Influence of Polar Solvents on Growth of Potentially NLO Active Organic Single Crystal N-Benzyl 2-Methyl-4-Nitroaniline and Efficiency of Terahertz Generation: a significant enhancement

**K. Thirupugalmani, S. Karthick, S. Brahadeeswaran***
Crystal Research Laboratory, Department of Physics, Bharathidasan Institute of Technology (BIT), Anna University, Tiruchirappalli-620024, Tamil Nadu, India

The N-Benzyl 2-Methyl-4-Nitroaniline (BNA) was synthesized in the laboratory and the growth of BNA crystal was performed in selected single and mixed protic and aprotic polar solvents. These attempts, i.e. to grow large BNA crystals in such solvents, have been reported, to the best of our knowledge, for the first time. The compositions and crystalline phases of the BNA crystals grown from these solvents were found to be identical. The morphologies of the BNA crystals grown in different solvents exhibited significant variations due to changes in growth rate. As for the adsorption of inclusions are concerned, it was observed that the interaction between the solute-solvent pairs play crucial role at the crystal-solution interface and that incorporations differ significantly along polar axes. The solvents were found to be adsorbed more severely along +c axis as compared to that along –c axis for the case of DMSO: acetonitrile (1:0.5) and ethanol: methanol (1:1) grown BNA. However, for the case of acetonitrile and ethanol: methanol: acetonitrile (1:1:1) grown BNA the adsorption was nearly unidirectional (+c axis) and severe. The optical transmission studies revealed that the BNA crystals grown from the selected solvents exhibited relatively higher transmission between 525 and 800 nm and the highest transmission limit observed for the DMSO grown BNA crystal, especially at 800 nm, assumes more significance since the wavelength range 780 to 820 nm employed for the generation of THz waves using Ti: Sapphire laser is usually centred around this wavelength. Further, the studies on the surface qualities of the BNA crystals obtained from the solvents explored revealed that the ethyl acetate, ethanol: methanol (1:1) and DMSO grown BNA possessed relatively lower FWHM values and the DMSO grown BNA yielded crystals with a lowest FWHM.




*Photographs of BNA single crystals and its sizes with different solvents*




*Schematic representation of desolvation and the rate of growth of various surface layers of BNA single crystal*

The THz measurements made for these crystals revealed that the ethanol: methanol (1:1), ethanol: methanol: acetonitrile (1:1:1), ethyl acetate and acetonitrile solvents exhibited slight variations in the THz efficiencies between 0 and 3 THz whereas there was overall higher THz efficiency observed for the BNA crystal grown from DMSO solvent in this range. This significant enhancement in the THz efficiency could be attributed to the relatively less incorporation of DMSO molecules and higher bulk and surface qualities of the BNA grown from this solvent as compared to BNA grown from other solvents explored for the present study. Hence it is concluded that high quality BNA single crystals could be grown from highly polar aprotic solvent DMSO, which, to the best of our knowledge, has been identified for the first time for the growth of BNA crystal (in addition to ethanol which is presently being used to grow BNA).

**Reference**

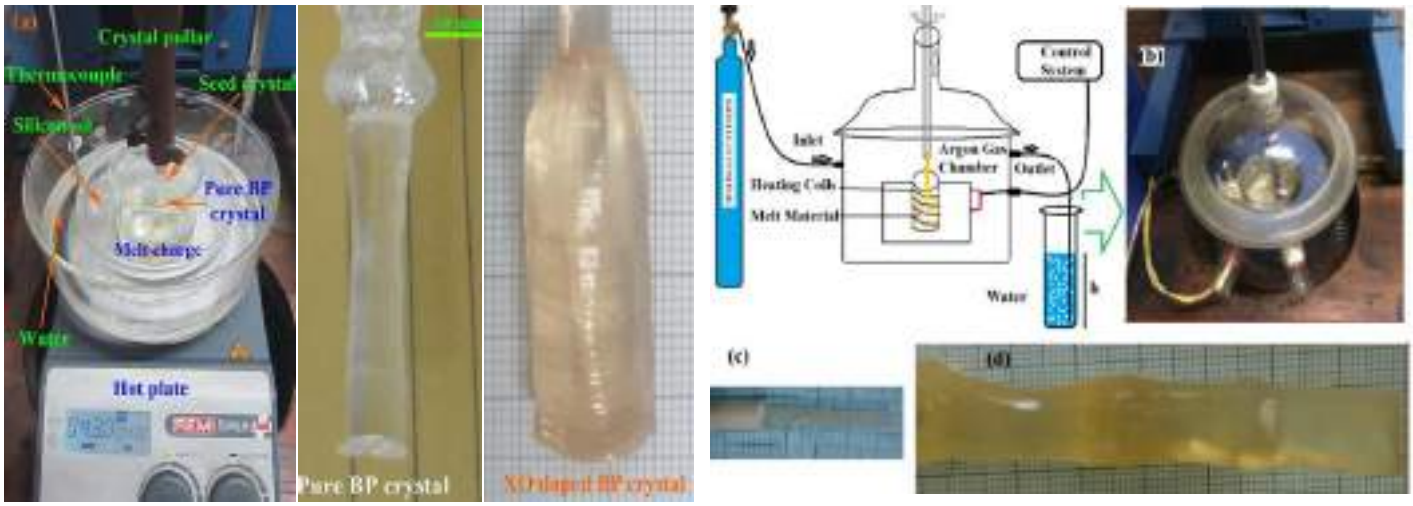
[1] K. Thirupugalmani, S. Karthick, K.K. Maurya, N. Vijayan, A.K. Chaudhary, S. Brahadeeswaran, Cryst. Engg. Comm. 2018

# Modification in Czochralski (Cz) system for the growth of low melting point materials and New model for crystal morphology

**Harsh Yadav, Nidhi Sinha, Binay Kumar***

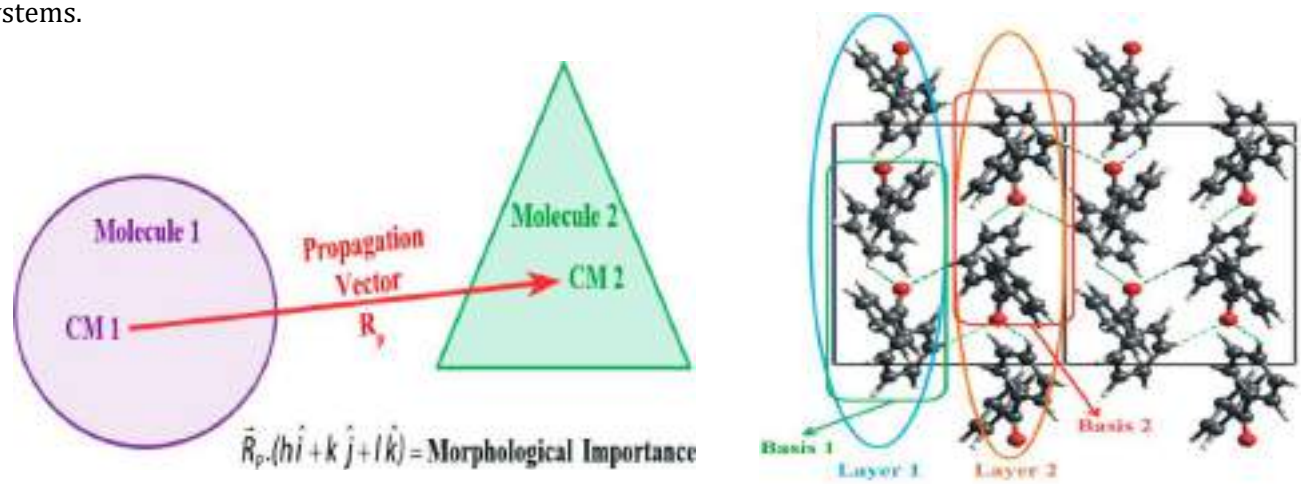
Crystal Lab, Department of Physics and Astro Physics, University of Delhi, Delhi-110021, India

Organic crystals are normally grown by solution technique. A low cost CZ system has been designed and fabricated in which the organic compound is melted in a constant temperature water/oil bath instead of the resistive cylindrical furnace. This system is found suitable for the growth of single crystals of low melting point organic materials. The system is further modified to put the whole charge is put within a closed chamber so that the growth can take place in an inert atmosphere at high pressure.




*(a, b) Experimental setup of modified Czochralski crystal growth system and (c, d) the grown pure and XO doped BP crystals*

The prediction of crystal morphology is important both for theoretical studies and device applications. We developed a new geometrical model in which crystal morphology is determined from the propagation vector of center of mass of the molecular basis in the crystal lattice. The method has been applied to determine the morphological importance and develop crystal morphology of various compounds like benzophophenone, benzil, and LPT crystals. The predicted morphology was compared with the results based on other models like BFDH and HP theories and with the experimentally observed morphology. It has been established that the determination and application of the proposed HNB propagation vector are easy and more accurate to predict the crystal morphology and can be applied to various complex molecular systems.




*New geometrical modeling to study the crystal morphology*

**References**

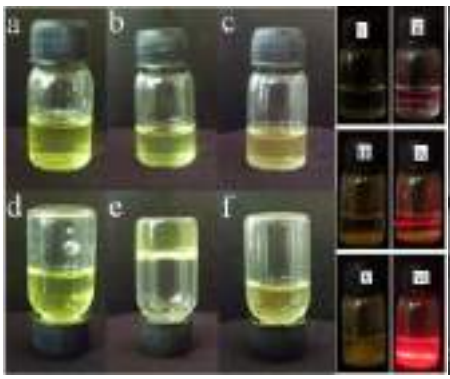
[1] Harsh Yadav, N. Sinha, Binay Kumar, J. Cryst. Growth 450 (2016) 74–80.

[2] Harsh Yadav, Nidhi Sinha, Binay Kumar, Cryst. Growth Des. 16 (2016) 4559–4566.

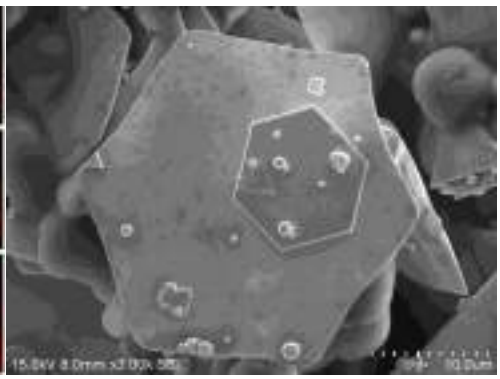
# Forming Nano and Micro Crystals of Metals Using Self Collapsing Gels – A new and Novel Technique

**Radha Perumal Ramasamy**
Department of Applied Science and Technology, Anna University, Chennai-600025, Tamilnadu, India

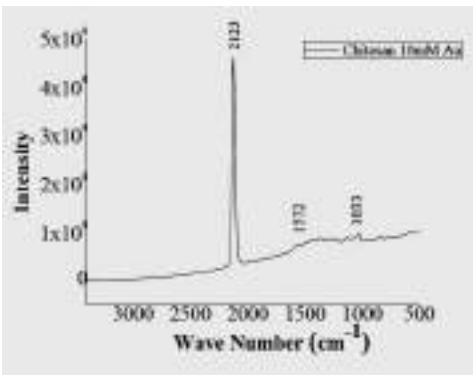
Synthesis of nano and micron sized gold particles using chitosan is investigated. Depending upon the concentration of $HAuCl_4 \cdot 3H_2O$ added to chitosan solution, gels are formed. These gels collapse in time leading to formation of nano particles and later micron sized particles of gold. The hydro gel is found to be porous. varied shapes and sizes of gold particles are observed to form in the gels. Raman spectroscopy revealed that surface enhanced raman scattering (SERS) is observed due to interaction between gold and the chitosan. Also, these self collapsing gels can be used to grow uniform sized gold nanoparticles upon carbon nanotubes (CNTs) and graphene.




*Optical image of chitosan-gold gels*

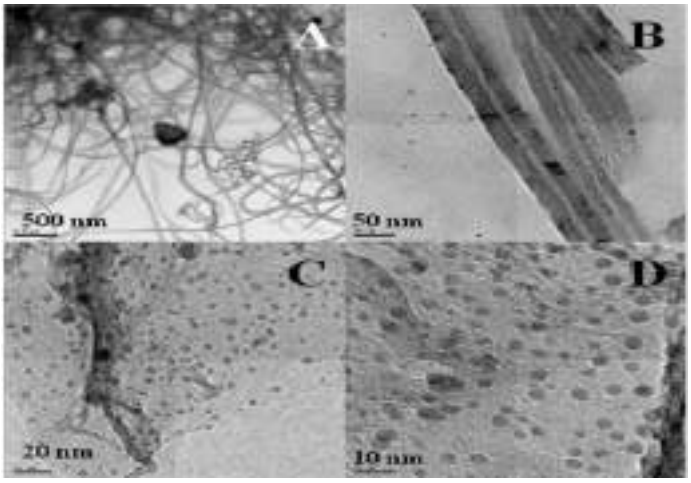


*Micro crystals of gold*

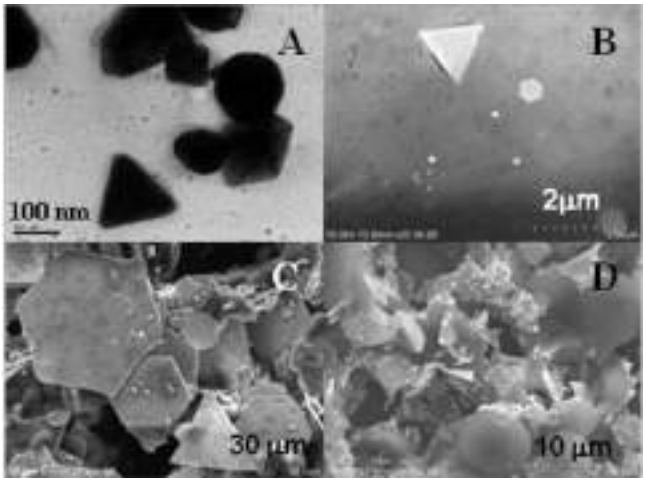



*Raman spectra for chitosan- Au gel*

Figure.1 (a-f) shows the optical image of the chitosan-3 mM Au solution. It was observed that gel formed in a few hours and in 24 hrs it was completely in gel form. In about 48 hrs the gel collapsed and it became liquid again. Figure.2 shows the sizes of the gold particles formed from the collapsed gels. Fig. 3 shows the TEM image of gold particles formed using chitosan-5 mM Au. The TEM image was done 10 days after preparation of the gel. It is observed that a few gold particles of size ~ 100 nm is observed. These particles are in varied shapes such as triangular, hexagonal, rhombohedra and spherical. The majority of the particles looked as tiny spheres with diameter ~ 20 nm. Figure 4 shows the SEM image of a micro crystal of gold obtained from self collapsed chitosan-5mM Au gel two months from the time of preparation of the gel. It can be observed that the contrast on the surface of every crystal is nearly the same indicating that the crystals are smooth. Also it can be observed that crystals of different shapes are lying on top of each other in a parallel fashion. This indicates that the individual crystals are single crystals and some regions of the crystals might accommodate for nucleation of crystal of different shape.




*SEM images of gold nanoparticles formed on CNT and graphene using self collapsing gels*

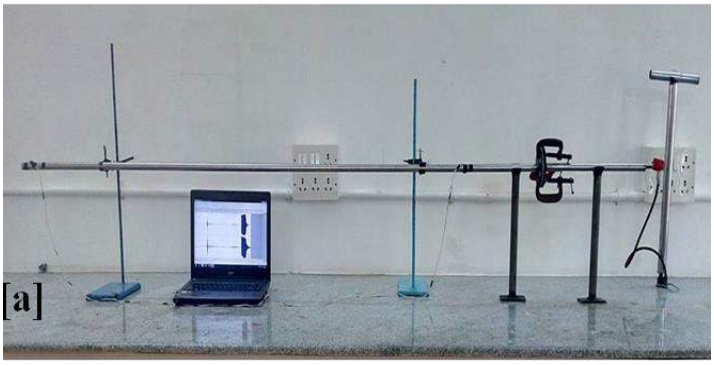



*TEM and SEM images of nano and micro crystals of gold*

# Shock Waves – A new tool for characterization of crystals

**A. Sivakumar, S. A. Martin Britto Dhas***
Abraham Panampara Research Center, Department of Physics, Sacred Heart College,
Tirupattur-635601, Vellore District, Tamilnadu, India

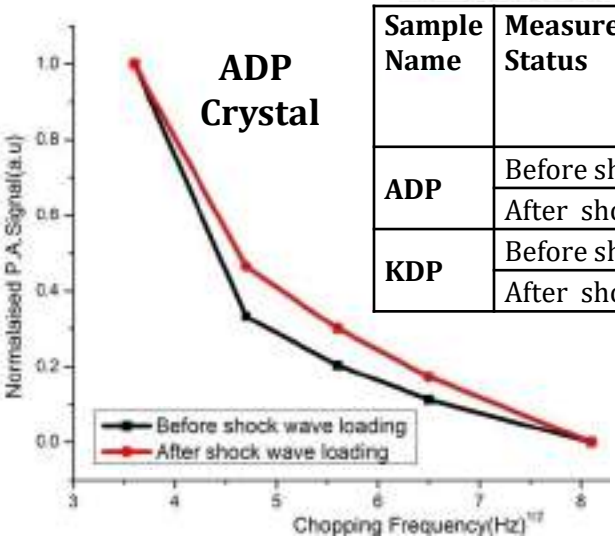
In our laboratory, we have couple of indigenously developed manually operated shock tubes and semiautomatic table top pressure driven shock tube facility. Fig.1 (a) and (b) show manually operated shock tube and table top pressure driven semi automatic shock tube respectively. Using these shock tubes we can generate shock waves with Mach number 1.1 to 5.0 shock waves and the corresponding transient pressure of the shock waves from 1.1MPa to 16.5 MPa. The present investigation deals with impact of shock waves on structural and thermal transport properties of Ammonium Dihydrogen Phosphate (ADP) and Potassium Dihydrogen Phosphate (KDP) crystals. The test crystals were grown by slow evaporation method at ambient temperature and subjected to one-dimensional 'loading of shock waves' with Mach number of 1.9 using supersonic low energy table-top shock tube.




*Manually operated table top pressure driven shock tube*


*Table -top pressure driven semi automatic shock tube*

The pre and post shock wave loaded crystals were subjected to X-ray diffraction studies. In both the cases, the numbers of the peaks are same but the intensity of the peaks is reduced and small shift in position are observed for the shock loaded crystals. In the case of ADP, the peaks obtained after the shock is little shifted towards the lower angle and the full width at half maximum also decreased around half of the initial value. From Fig.2 (a) it is clear that the grain size of the ADP crystal has increased from 4.9 to 9.40 nm after loading of shock waves. The enhancement of grain size of the ADP crystal is due to the fusion of the couple of grains to a single grain while the shock waves passes through the crystal. Thermal transport values such as thermal diffusivity, thermal conductivity and thermal effusivity of ADP crystal also enhanced for shock wave loaded condition and it is due to the enhancement of grain size of the test material. Higher thermal transport property is favorable for high power laser applications. In case of KDP crystal grain size and thermal transport properties are not affected significantly which is evidenced by XRD spectrum and Photoacoustic analysis. The obtained XRD spectrum and normalized PAS signal is shown in Fig.2 (b).




| Sample Name | Measurement Status | Thermal diffusivity ($\alpha$) $\times 10^{-6}$ ($m^2/s$) | Thermal Effusivity (e)$\times 10^3$ ($Jm^{-2}k^{-1}s^{-1/2}$) | Thermal conductivity (k) ($W\,m^{-1}k^{-1}$) |
|---|---|---|---|---|
| ADP | Before shock | 0.678 | 1.463 | 1.204 |
| | After shock | 1.552 | 2.214 | 2.758 |
| KDP | Before shock | 1.055 | 2.376 | 2.441 |
| | After shock | 1.140 | 2.470 | 2.637 |

**References**
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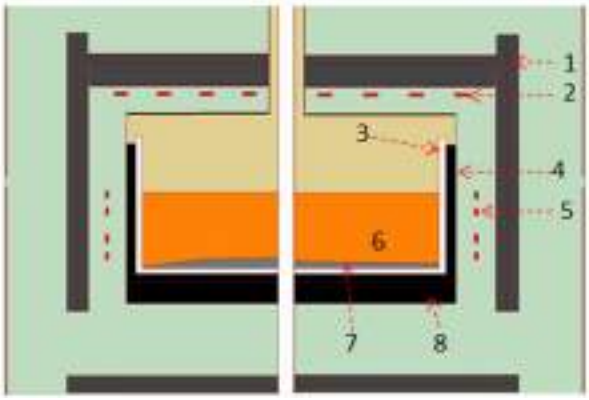
[2] K.P.J Reddy, N.Sharath, Curr. Sci 104 (2013) 172-176.
[3] Kai Kadau, Timothy C. Germann, Peter S. Lomdahl, Brad Lee Holian, Science 296 (2002) 1681-1684.

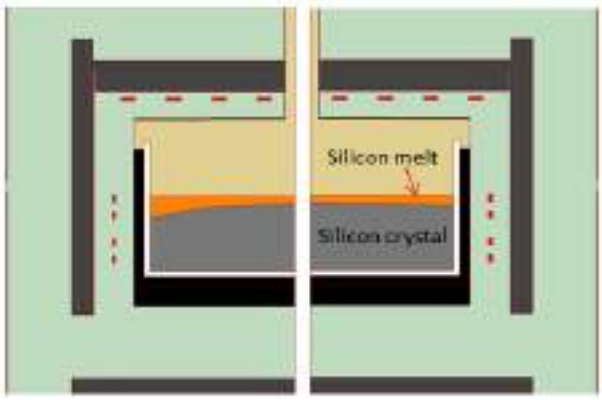
# Growth of high performance multi-crystalline silicon ingots: dual power vs. single power controlled directional solidification system

**N. Balamurugan**
GT Advanced Technologies, 243 Daniel Webster Highway, Merrimack, NH 03054, USA

The utilization of dual power control in a directional solidification system (DSS) is shown to help grow higher quality multi-crystalline ingots, particularly high performance ingots with seeded growth. Since the power ratio to the top and the side heaters is tunable, this allows optimal control of the power profile and the solidification front throughout the entire casting process. A dual power controlled DSS (DP-DSS) with separate power control to top and side has achieved faster melting, better seed retention, and more vertical grains while consuming less energy than a single power controlled DSS (SP-DSS).




*Schematic illustration of seed level profile created by (a) Single Zone Power Control (Left) and (b) Dual Zone Power Control (Right)*



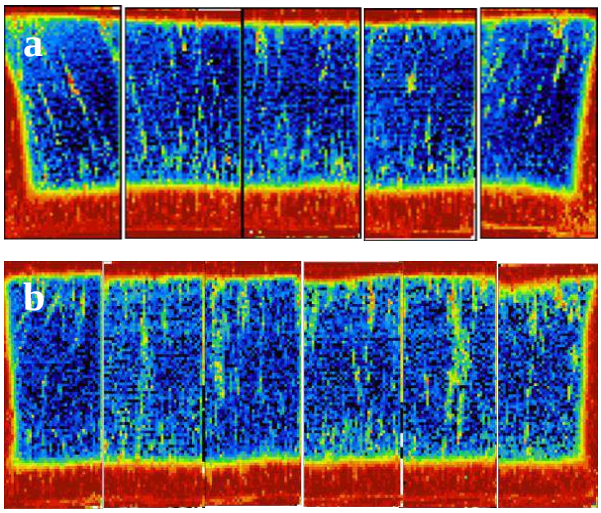

*Schematic illustration of growth end stage profile created by (a) Single Zone Power Control (Left) and (b) Dual Zone Power Control (Right)*

GTAT's DSS450HP and DSS850 were used for this study. The DSS450HP is a single power controlled system i.e. fixed power ratio to side heater and the DSS850 is dual power controlled system i.e. variable power ratio to the side heater. All the remaining parts are similar except the size of the hot zone. A commercially available G5 crucible was used in DSS450HP and G6 crucible was used in DSS850. The entire bottom of the crucible was filled by crushed mono/multi wafers or multicrystalline chips with a seed layer about 25 mm thick. Seed material was sieved to ensure a maximum particle size diameter of 5 mm. In the single power controlled process, the power ratio to the top and side heaters was fixed, while for the dual power controlled process the power ratio at the top and side heaters was adjusted throughout the casting process. The same crossover temperature was set for both systems so they performed very similarly until the transition from heat to melt. After crossover, the insulation cage in SP-DSS was opened enough to maintain the seed while continuing melt back of the bulk material.

In the DP-DSS, the power to the side heater was drastically reduced and the insulation opened to a lesser extent for the same purpose. In DP-DSS, the power to side heater during melt back is almost reduced to zero whereas the side heater always contributes 50% of the total power in SP DSS resulting in a more convex seed-melt interface as shown in Figure. Once the growth stage was started in the DP-DSS, the power to the side heater was increased to suppress crystal nucleation from the side walls of the crucible. As growth progressed, the side power was gradually decreased to help maintain a nearly flat liquid-solid interface throughout the stage. The shape of the growth front at the end of the growth stage is compared and shown in Figure. Several seeded multi-crystalline silicon ingots were grown using the dual power controlled DSS (DSS850) and single power controlled DSS (DSS450HP) in a production environment.

*Directional Solidification System made by GT Advanced Technology, USA*

The grown ingots were cut into bricks and evaluated by Semilab's minority carrier lifetime scanner. The solid-liquid interface shape at the seed layer is more convex (Figure 4 (a) – Yellow line) with the SP-DSS process resulting in complete melting of the seeds at the ingot corners. Moreover, the liquid-solid interface becomes more convex or concave towards end of growth causing difficulty in maintaining a vertical grain structure. Similar results of convex interface with seeded growth were published by Zhang et al [6]. In contrast, the DP-DSS process achieves a nearly flat solid-liquid interface (Figure 4 (b)-Yellow line) at the seed level with minimal cage opening and maintains a nearly flat interface to the end of growth by dynamically changing the power to both the top and side heaters.




*Lifetime images of silicon bricks from (a) single power controlled DSS and (b) dual power controlled DSS. Yellow lines are added to both images to enhance the visual clarity*

DP-DSS reduces melt and corner growth times and lowers power consumption compared to SP-DSS. The data is compared in Table.

| Parameters | Single Power Control | Dual Power Control |
|---|---|---|
| Top/Side Heater Power Ratio | Fixed | Tunable |
| Cage Opening During Melting | More | Less |
| Seed Thickness | 20mm | 15mm |
| Seed Loss | 20% | 2% |
| Normalized Power Usage | 1 | 0.83 |
| Normalized Melting Rate | 1 | 1.5 |
| Normalized Corner Growth Time | 1 | 0.63 |

There are several advantages to the use of dual zone power control which all collaborate to improve the productivity of ingot casting operations. In particular, when seeded growth is desired, varying the power input throughout a batch has dramatic results. Heat and melt stages can be tuned to maximize power input while minimizing the required cooling influence, thereby allowing reduced power consumption and processing time. The optimization also allows for consistently larger seed retention areas and thinner seed layers. By improving seed retention at the corners and sides of the ingot, bricks harvested from these locations can yield higher performance wafers compared to similar bricks produced by the fixed ratio of single zone power control. Achieving thinner seeds requires less virgin seed material for crucible loading and results in reduced red zones providing more waferable material per brick. Similarly, the growth recipe can be optimized to achieve a near horizontal solid-liquid interface. This allows for vertical grain structures throughout the ingot cross section and reduced operation time to solidify the ingot corners. There are also potentially less thermal stress induced defects due to the reduced temperature gradient which should be studied in more depth.

*Dr. N. Balamurugan with Prof. P. Ramasamy in GT Solar, China*

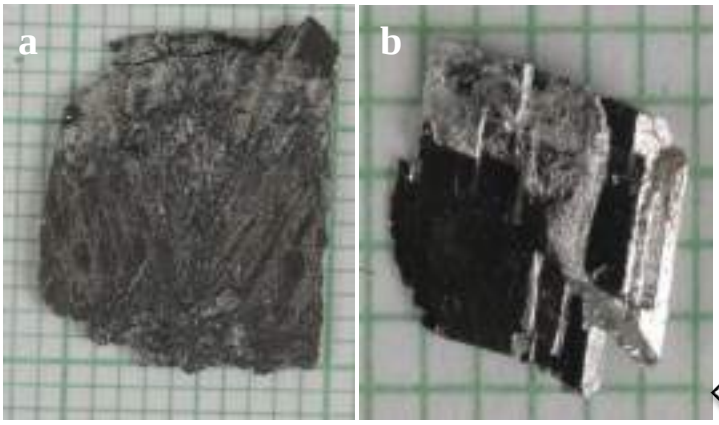
*Multi-crystalline silicon grown by Dr. N. Balamurugan using Directional Solidification System (DSS) at China*

# Understanding the properties of systems with strong electronic correlations : in Single and Poly Crystals

**R. Nagalakshmi**

Department of Physics, National Institute of Technology, Tiruchirappalli-620015, Tamilnadu, India

Preparation of poly and single crystalline rare earth intermetallic compounds (3D transition metals, rare earth and uranium) which exhibits strong electron correlations at low temperatures by arc melting and flux growth techniques respectively. The physical properties are measured using the techniques of electrical resistivity, magnetization and specific heat in the temperature range 1.8-300 K and applied magnetic fields ranging from 9-12 T followed by the analysis of data. To be internationally competitive and to have a greater impact, it is essential to work on single crystals for anisotropic characteristics. In order to probe the intrinsic properties of a compound it is necessary to study single crystals which are devoid of extrinsic effects arising from grain boundaries. Similarly, systems where the physical behavior arises due to structural units such as chains, planes, ladders, etc. are better understood when studied in single crystal form.




Some important findings: (Single crystals of REI compounds were grown in TIFR, Mumbai and Polycrystals at NITT). In the study of FeAs systems, for Co-doped single crystals of $CaFe_{1.94}Co_{0.06}As_2$ a superconducting transition is observed at T= 17 K and reported for the first time in literature. Strongly correlated behavior in $R_2Ru_3Ga_9$ polycrystal. $Ce_2RhGa_{12}$ - Antiferromagnetic magnet at $T_N$=3.5K & a large magnetocrystalline anisotropy in single crystals.

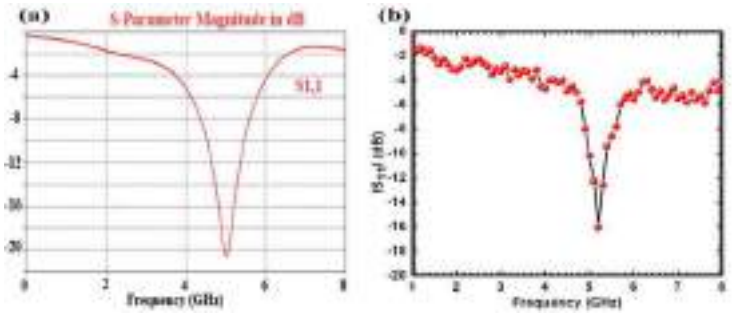
*(a) $CaFe_2As_2$ (b) $CaFe_{1.94}Co_{0.06}As_2$*

# L-arginine Bis(trifluoroacetate) single crystal: A nonlinear optical (NLO) material for microstrip patch antenna applications

**Sonia, N. Vijayan**

Crystal Growth Section, CSIR-National Physical Laboratory (NPL), New Delhi-110012, India

In many wireless communications such as Wi-Fi, LAN, Bluetooth, pressure sensor, temperature sensor and crack propagation patch antennas are needed to realize various technological aspects of the consumer electronics. Therefore, designing of patch antenna on the LABTF single crystal shown in Fig. 1. Substrate having low dielectric constant seems necessary. Patch antenna fabricated on the LABTF crystal can be used for various wireless communication applications. The simulation of micro strip patch antenna was performed using CST Microwave studio at 5 GHz resonant frequency. Inset feed of the patch antenna was fed by 50 Ω micro strip line. Copper sheet of thickness 1.04 mm was used for the fabrication of both patch and ground plane of the antenna. Fig. (a) displays the simulated S11 parameter of the rectangular patch antenna at 5 GHz resonant frequency with the return loss of -22 dB.




The operating frequency of the fabricated patch antenna experimentally was observed at 5.2 GHz with a return loss of -16 dB (Fig (b)). For the advancement of wireless communication, these devices can solve the various purpose for smart technology with compact design. Furthermore, in the case of piezoelectric substrate for patch antenna, the same device is extended for pressure and position sensor applications.

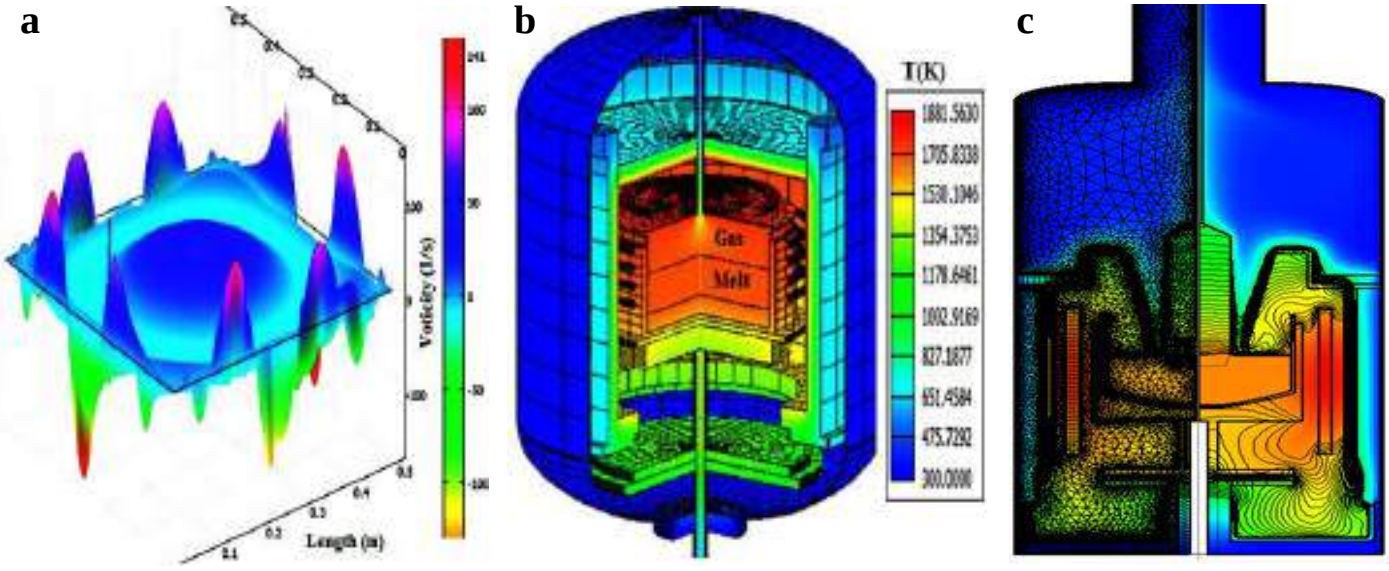
*(a) Plot of simulated $S_{11}$ parameter against frequency with a resonance frequency at 5 GHz. (b) Plot of experimentally measured $S_{11}$ parameter versus frequency and observed resonance peak at 5.2 GHz*

# India's first indigenously developed DS furnace for growing mc-Si ingot for photovoltaic (PV) applications

**M. Srinivasan**
SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, India

Multi-crystalline silicon is an important material with advantages of low-production cost and high conversion efficiency of solar cells. Market share of mono- and multi-crystalline silicon (mc-Si) is more than 90% at present and will be so in the foreseeable future. Indian solar cell industries import silicon cells and convert them into solar modules. Today 98% of the silicon cells imported into country are mc-silicon cells. No serious research activities have been done on the mc-Si crystal growth modelling as well as experiments in Indian laboratories. **Prof. P. Ramasamy** took initiative to start the modelling activities on silicon growth six years ago in SSN Research centre, and experimental activity a year ago with the support of **MNRE,** Government of India. Modelling and experimental mc-Si growth lab are established well in SSN RC. Several Ph.D. scholars and scientists are currently working in the field of mc-Si growth process and are getting good results. The growth of mc-silicon in the directional solidification system involves complex nonlinear transport phenomena of heat and mass transfer. This work focuses on simulation and optimization of directional solidification silicon growth process and build a fundamental baseline process for understanding of DS process using Solar Grade Silicon (SoG-Si) as feedstock and resulting in a baseline solar cell efficiency of 15% with an average lifetime of >4 µ.sec. The segregation and precipitation of the impurities in the mc–Si has serious problems, which affect the performance of the solar cells. They can be controlled by simulating the growth process using numerical methods. The stress and dislocation density are main factors which are reduced using various modification in DS furnace and optimizing the control parameters.

Based on this work, around 30 papers have been published in International journals and Proceedings. The key to achieving high solar cell efficiency is to increase average grain size in silicon multi-crystals and reduce dislocation density. Unsteady global modelling of heat and mass transfer including melt convection, argon flow, thermal conduction, thermal radiation and phase change in a directional solidification furnace for multi-crystalline silicon ingot for solar cells are carried out. Modelling on Cz silicon growth process also has been initiated in SSN Research Centre.




*(a) Modelling on Silicon melt flow pattern (b) Global heat transfer of DS furnace*

*(c) Cz silicon growth process*

**Reference**

[1] Vinh Trung Phan, Anh Quynh Le, Dat Thanh Huynh, American Journal of Phys. Appl. 6 (2018) 11-17.

# Crystal Growth Researchers received National Fellowships

**Dr. A. Silambarasan**
National Post Doctoral Fellow
C/o Prof. Suja Elizabeth
Department of Physics
Indian Institute of Science
Bangalore-600025
kavianbuarasu@gmail.com

**Dr. R. Suria Karthick**
UGC-DSK Post Doctoral Fellow
C/o Prof. C. Venkateswaran
Department of Nuclear Physics
University of Madras
Chennai-600025
suriakarthick@gmail.com

**Dr. N. Sivakumar**
UGC-DSK Post Doctoral Fellow
C/o Prof. R. Jayavel
Crystal Growth Centre
Anna University
Chennai-600025
nsivakumar1986@gmail.com

**M. Divya Bharathi**
UGC - Rajiv Gandhi Fellowship
C/o Prof. G. Anbalagan
Department of Physics
Presidency College
Chennai-600005
divya1341993@gmail.com

**Logu Thirumalaisamy**
CSIR - Senior Research Fellow
C/o Dr. K. Sethuraman
School of Physics
Madurai Kamaraj University
Madurai-625021
astrologu10@gmail.com

**Bhoomika V. Jogiya**
UGC - BSR Meritorious Fellow
C/o Prof. Mihir. J. Joshi
Department of Physics
Saurashtra University
Rajkot-360005, Gujarat
mshilp24@rediffmail.com

**Mohd Anis Abdul Wahed**
UGC-Maulana Azad National Fellow
C/o Dr. Gajan G. Muley
Department of Physics
Sant Gadge Baba Amravati
University, Maharashtra
loganees@gmail.com

**A. Lakshmanan**
UGC - Rajiv Gandhi Fellowship
C/o Dr. P. Ramesh Kumar
Department of Physics
Periyar E.V.R College
Tiruchirappalli-620023
laksh1551989@gmail.com

**P. Surendran**
UGC - National Fellowship for
Higher Education, C/o
Dr. P. Ramesh Kumar, Department
of Physics , Periyar E.V.R College
Tiruchirappalli-620023
suretamil1992@gmail.com

# FORTH-COMING EVENTS IN CRYSTAL GROWTH

- The 26th AACGE Western Section Conference on Crystal Growth & Epitaxy, 10-13 June 2018, Stanford Sierra Camp, Fallen Leaf Rd, South Lake Tahoe, CA, USA **Web:** *http://www.crystalgrowth.org*
- 2nd European School on Crystal Growth (ESCG-2), 13-16 September 2018, Riviera Holiday Club Varna, Bulgaria, **Web:** *http://www.iocg.org*
- 6th European Conference on Crystal Growth (ECCG-6), 16-20 September 2018, Riviera Holiday Club, Varna, Bulgaria, **Web:** *http://www.iocg.org*
- International Workshop on Modeling in Crystal Growth (IWMCG-9), 21-24 October 2018, Big Island, Hawaii, USA, **Web:** *http://www.iocg.org*
- 17th International Summer School on Crystal Growth (ISSCG-17), 21-27 July 2019, Colorado, USA, **Web:** *www.crystalgrowth.org*
- National Seminar on Recent Trends in Materials Science (NSRTMS-18), 2 February 2018, Depart. of Physics, Theivanai Ammal College for Women, Villupuram-605401, Tamilnadu
- 4th National Seminar on Technologically Important Crystalline and Amorphous Solids (TICAS-2018), 2-3 March 2018, Department of Physics, Kalasalingam Academy of Research and Education, Virudhunagar-626126, TN, **Web:** *http://kalasalingam.ac.in/site/*
- 6th National Conference on Hierarchically Structured Materials (NCHSM-2018), 16 February 2018, Department of Physics, SRM Institute of Science and Technology, Ramapuram, Chennai-600089, Tamilnadu, **Web:** *http://www.srmuniv.ac.in*
- National Conference on Recent Trends in Physics of Materials (NCRTPM-2018), PG and Research Department of Physics, 9-10 February 2018, Pachaiyappa's College, Chennai-600030, Tamilnadu, **Web:** *http://researchap.com*
- National Conference on Advances in Materials Research (NCAMR-2018), 27-28 April 2018, Department of Physics, SRM Institute of Science and Technology, Vadapalani, Chennai-600026, TN, **Web:** *http://www.srmuniv.ac.in/ramapuram-part-vadapalani/*
- National Conference on Recent Advances in Chemical and Materials Science (RACMS-18), 3 February 2018, Department of Physics, School of Engineering and Technology, Jain University, Bangalore-562112, Karnataka, **Web:** *https://www.jainuniversity.ac.in/*
- One Day National Conference on Advances in Condensed Matter Physics (NCACMP-2018), 2 March 2018, Department of Physics, Hindustan Institute of Technology and Science, Chennai-603103, Tamilnadu, **Web:** *https://www.hindustanuniv.ac.in/*
- 20th International Conference on Crystal Engineering and Chemical Crystallography (ICCECC 2018), 22-23 February 2018, Mumbai, India **Web:** *https://waset.org/conference/2018/02/mumbai/ICCECC*
- National Conference on Processing and Fabrication of Advanced Materials (NCPFAM-2018), 1-2 March 2018, Department of Physics, SSN College of Engineering, Kalavakkam, Chennai-603110, Tamilnadu, **Web:** *http://www.ncpfam2018.com/index.html*

# BEST PAPER PRESENTATION AWARDS


**Dr. K. Tirupugalmani**, BIT-Anna University received **Dr.RG National Award for BEST THESIS** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Dr. P. Vijayakumar**, IGCAR, Kalpakkam received **Dr.RG National Award for BEST THESIS** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Dr. K. Boopathi**, CGC, Anna University received **Dr.RG National Award for BEST THESIS** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Dr.M. Vijayalakshmi,** VSA Group of Institutions received **BEST CRYSTAL DISPLAY AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Dr. S. Rajyalakshmi**, Govt. College, Rajamundry received **BEST CRYSTAL DISPLAY AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**A. Saranraj & J. Tirupathy,** Sacred Heart College received **BEST CRYSTAL DISPLAY AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**V. Sivasubramani & P. Karuppasamy,** SSNCE received **BEST CRYSTAL DISPLAY AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**N. Ravi Kumar,** PSG College of Tech. received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**S. Sivaraman**, Annamalai University received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**R. Govindaraj,** SSN CE received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**A. N. Vigneshwaran**, Govt. College, Kumbakonam received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**R. Karthick,** National College received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**P. A. Praveen,** Bharathidasan University, Trichy received **BEST ORAL PRESENTATIONAWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**G. Shyam Shendur,** Anna University, Chennai received **BEST ORAL PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**I. MD. Zahid**, Presidency College received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**G. Iyappan,** SSN CE received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**L. Jayanthi**, Sri Sarada College for Women, Salem received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**S. Nandhini,** Presidency College received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**J. Martin Sam Gnanaraj,** Govt. Arts College, Trichy received **BEST POSTER PRESENTATIONAWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**T.N. Narayana Swamy,** Yuvaraja's College, Mysore received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**N. Durairaj**, VIT University, Vellore received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Manisha Joshi,** Jai Hind College, Mumbai received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**T. Dhandayuthapani**, Alagappa University received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Apurva Gupta,** Jamia Millia Islamia, Delhi received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**Dr. K. Moorthy,** The American College, Madurai received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


**R. Anbarasan,** Periyar University, Salem received **BEST POSTER PRESENTATION AWARD** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. RO.MU. Jauhar**, Pachaiyappa's College received **BEST TRANSLATOR AWARD** in the ICRAST-2017 held at Centre for Nanoscience & Tech. Anna University, Chennai during 8-9th September 2017

**Dr.G. Poongodi**, Quaid-e-Milllath Govt. College for Women, Chennai received **BEST TRANSLATOR AWARD** in the ICRAST-2017 held at Centre for Nanoscience & Tech. Anna University, Chennai during 8-9th September 2017

**Dr. G. Karunagaran**, SSNCE, Chennai received **BEST TRANSLATOR AWARD** in the ICRAST-2017 held at Centre for Nanoscience & Tech. Anna University, Chennai during 8-9th September 2017

**Dr. K. Dhanabalan**, National College, Trichy received **BEST PAPER PRESENTATION AWARD** in the RCMS-2017 held at Department of Physics, Sree Sevugan Annamalai College, Devakottai during 15th July 2017

**J. Thirupathy,** Department of Physics, Sacred Heart College, Tirupattur received **BEST ORAL PRESENTATION AWARD** in International Conference on Smart Materials held at Gonzaga College during 17th October 2017

**A. Sivakumar** and **C. Victor**, Department of Physics, Sacred Heart College received **BEST PAPER AWARD** in International Zonal Level Project Competition held at Department of EEE, Kottayam, Kerala on 27th July 2017

**Dr. S. Gnanam**, Vels University, Chennai received **BEST ORAL PRESENTATION AWARD** in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017

**A. Divya**, Department of Physics, NMSSVN College, Madurai received **BEST ORAL PRESENTATION AWARD** in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017

**Jaydeep H. Joshi**, Saurastra University, Rajkot, Gujarat received **BEST ORAL PRESENTATION AWARD** in ISSRTST-2017 held at Christ College, Rajkot, Gujarat during 26-27th February 2017

**A. Jennifer Christy**, Bishop Heber College, Trichy received **BEST PAPER PRESENTATION AWARD** in the RCMS-2017 held at Department of Physics, Sree Sevugan Annamalai College, Devakottai during 15th July 2017

# CONFERENCE HIGHLIGHTS

## XXI National Seminar on Crystal Growth and Applications (XXI NSCGA-2017) in association with Indian Association for Crystal Growth (IACG), 6-8th March 2017

PG & Research Department of Physics, National College, Tiruchirappalli-620001, TN

The "21st National Seminar on Crystal Growth and Applications" was organized by PG and Research Department of Physics, National College, Tiruchirappalli during 6-8th March 2017. This was partially supported by the University Grant Commission (UGC) and Indian Association for Crystal Growth (IACG). This was the 21st in the series of such seminars dedicated to crystal growth and held at various universities working in this area of research. This was the first time that it was held at National College. **Prof. P. Ramasamy**, President IACG was the chairman NSCGA-2017 of the seminar with **Dr. A.T. Ravichandran** acting as the Convener NSCGA-2017 and **Dr. Muthu Senthil Pandian** and **Dr. S. Pari** the Co-Convener NSCGA-2017. **Prof. Narayana Kalkura**, Director, Crystal Growth Centre, Anna University was the chief guest in the inaugural function and he also gave the inaugural address. **Shri. K. Raghunathan** unveiled the Abstract Book of the seminar. The newsletter of ***Indian Association for Crystal growth (IACG), Issue-29*** was unveiled by **Prof. S. Moorthy Babu**, Director, Centre for Nanoscience and Technology, Anna University, Chennai. The NSCGA-2017 was felicitated by **Prof. P. Ramasamy**, President-IACG and **Prof. Paulraj Manidurai**, University of Conception, Chile. **Dr.Suja Elizabeth**, Principal Research Scientist, IISc, Bangalore received Prof.P.Ramasamy National Award for Crystal Growth in XXI NSCGA-2017.

Total 225 manuscripts were received from all over the country working on crystal growth and related fields. Manuscripts were invited under 8 different topics ranging from growth of single crystals, Nano crystals to devices based on single crystals for societal benefits. The application of crystals for device fabrication was specially emphasized in the seminar. Around 250 participants from all over the country attended the seminar and presented their work. There were 32 invited talks given by eminent scientist coming from across the globe as well as throughout the country. The students participated from various education and research institutes interacted with the experts working in the areas of crystal growth, thin films and material science and enriched their knowledge in these areas. The seminar as a whole motivated and guided the participants to carry out their research in their respective fields and to produce many novel results. Thus the XXI NSCGA-2017 successfully ended by fulfilling the aim for which the seminar was organized.



**Dr. A. T. Ravichandran**
Associate Professor
PG and Research Department of Physics, National College, Tiruchirappalli-620001, Tamilnadu

# CONFERENCE HIGHLIGHTS

## 2nd International Conference on Advances in Materials Science and Technology (ICAMST 2017), 9-11th October 2017

Centre for Crystal Growth, School of Advanced Sciences,
VIT University, Vellore-632014, Tamilnadu

The 2nd International Conference on Advances in Materials Science and Technology (ICAMST 2017) was held during 9-11th October 2017 in VIT Vellore organized by Centre for Crystal Growth. The conference deals with the theme of advances in materials processing and applications in day to day life, such as emerging crystals, nanomaterials, biomaterials, electronic, optical, magnetic materials, piezoelectric materials, ceramics, polymer composites, metal alloys, smart materials, solar cells, energy storage materials, semiconductor materials and design of complicated structures through the innovation of technology by the advancements in the study of materials science. ICAMST Conference series has taken the chances to provide a common platform to scientific experts from various countries of academic and industry.

The 2nd ICAMST 2017 conference was served as right stage for the scientific community to meet experts with each other and to exchange thoughts. The scientific mission of this conference was offered a great platform to the research scholars from various disciplines to come together, present their recent finding and develop professional skills and links pointed at collaborative research. Many novel and innovative ideas to reform the field of Material science and its applications were evolved through the discussions and sharing between the distinguished professors and renowned scientists.

The conference was made by the dedicated team of organizers and the generous support from the CSIR and other sponsors. The conference was a great success, attracting 320 participants and 50 invited speakers from Japan, Germany, Spain, Poland, Australia and India. More than 280 authors have submitted their abstracts and papers to the conference. Accepted contributory papers are presented as Oral and Poster presentation. The scientists and researchers from various national laboratories, universities and research institutions of our country and foreign country were participated in the above conference and discussed on the growth of single crystals, preparation of nanomaterials, thin films, solar cells, and fabrication of practical devices. The peer review process was selected top hundred papers for publication in the periodical articles in the Mechanics, Materials Science & Engineering journal with, sponsored by the National University of Mines, Ukraine.


**Prof. S. Kalainathan**
Director
Centre for Crystal Growth, School of Advanced Sciences, VIT University, Vellore-632014, Tamilnadu

# CONFERENCE HIGHLIGHTS

## Summer Research Internship Programme (SRIP-2017)

**12-22st June 2017,** GRD Centre for Materials Research,
PSG College of Technology, Coimbatore-641004, Tamilnadu

Summer Research Internship Programme (SRIP-2017) was organized by the GRD Centre for Materials Research, PSG College of Technology, Coimbatore, during the period 12-22st June 2017. The programme was attended by several students pursuing undergraduation, post graduation and research in various science, and engineering streams, from various universities and colleges in Tamil Nadu. The programme included invited lectures, group discussions, laboratory visits, and every day practical sessions. The participants were exposed to a variety of topics relating to fundamentals of materials, synthesis of materials, characterization techniques, development of novel materials for specific applications, and lecture by industry personnel regarding the demands of the industry.
The following delegates were invited to deliver lectures to the participants.

| SPEAKER | DESIGNATION |
|---|---|
| Prof. P. Ramasamy | Director, SSN Research Centre, SSN Institutions, Chennai |
| Mr. S. Harish | CEO, M/s. Indfurr Superheat Furnaces, Chennai |
| Dr. Rama Ranjan Bhattacharjee, | Associate Professor, Textile Chemistry, PSG Institute of Advanced Studies, Coimbatore |
| Dr. T. Theivasanthi, | Assistant Professor, International Research Centre, Kalasalingam University, Krishnankoil |
| Dr. Anuradha M. Ashok, | Associate Professor, PSG Institute of Advanced Studies, Coimbatore |
| Dr. U. Madhusoodanan | Senior Scientist, RSEG, IGCAR, Kalpakkam |
| Dr. R. Ramesh Babu | Assistant Professor, Bharathidasan University, Tiruchirappalli |
| Dr. N. Meenakshi Sundaram | Assistant Professor, Government Arts College, Salem |
| Dr. S. Prasanna | Associate Professor (Physics), PSG College of Technology, Coimbatore |
| Dr. M. D. Kannan | Associate Professor & Head (Physics), PSG College of Technology, Coimbatore |
| Dr. Muthu Senthil Pandian | Research Scientist, SSN Research Centre, SSN Institutions, Chennai |
| Dr. R. Balasundaraprabhu | Assistant Professor (Physics), PSG College of Technology, Coimbatore |
| Dr. B.S. Panigrahi | Head, Luminescence Division, RSEG, IGCAR, Kalpakkam |

Participants were provided with individual worksheets on the research work they had to carryout during their stay in the programme. Research work on growth of single crystals from melt, solution method, and preparation of nano and micro phosphor materials were assigned, and the participants could accomplish the task during the stipulated time. In addition to the resource persons from various eminent organizations, research scholars of the GRD Centre had also presented their research work. The participants have found the programme very interesting & useful. The research outcomes of the programme are being submitted to various International Journals.

**Dr. R. Arun Kumar**
Centre in-charge and Associate Professor
GRD Centre for Materials Research, PSG College of Technology, Coimbatore-641004, Tamilnadu

## National Conference on Preparation and Characterization of Crystalline Materials (NCPCCM-2017), 5-6th September 2017

PG & Research Department of Physics, Government Arts College,
Tiruvannamalai-606603, Tamilnadu

The University Grants Commission (UGC) sponsored **National Conference on Preparation and Characterization of Crystalline Materials (NCPCCM-2017)** was organized by PG & Research Department of Physics, Government Arts College, Tiruvannamalai-606603 during 5-6th September 2017. **Dr. S.M. Ravi Kumar,** is the convenor of the conference, **Prof. R. Arunchunai Annadurai**, Head, Dept. of Physics, welcomed the guests and participants, **Dr. M. Chinniah** Principal, delivered the Presidential address and **Dr. P. Ramasamy**, Director, SSN Research Centre, SSN College of Engineering, inaugurated the conference. The purpose of this conference is to bring together scientists, experts, academicians and other researchers from different parts of the country actively engaged in the forefront of Preparation and characterization of crystalline materials for exchange of knowledge and ideas and an in depth analysis of the subject.

The **NCPCCM-2017** was covered the entire field of preparation and characterization of macro, micro and nano crystalline materials, from basic physical phenomena to the recent significant advancements in preparation techniques, materials characteristics, characterization techniques, etc. The scientific deliberations at the conference are covered a wide range of topics in crystal growth in the form of invited talk and contributory papers. Accepted contributory papers are presented as Oral and Poster Presentation. The most dynamic campaigns was done in this conference with intensive interaction among the research community to inculcate excitement regarding crystal growth, assessment and scientific method of knowledge transfer. I am sure that this conference would rejuvenate younger minds to get new ideas in the field of crystal growth and characterization. I am very much pleased to note that there were 10 Invited talks and more than 100 contributed papers from various institutions covering different aspects of preparation and characterization of crystalline materials. Thus, the scientist and researchers from various National Laboratories, Universities and research centers of our country participated in above conference and discussed on the growth of single crystals from various technique. The conference as a whole motivated and guided the participants to carry out their research in their respective fields and to produce any novel results. Thus the NCPCCM-2017 successfully ended by the fulfilling the aim for which the conference was organized.

**Dr. S.M. Ravi Kumar**
Assistant Professor, PG & Research Department of Physics,
Government Arts College, Tiruvannamalai-606603, Tamilnadu

# CRYSTAL GROWTH PROJECTS-2017

**PI: Dr. Amirdha Sher Gill, Asst. Professor, Department of Physics,**
**Sathyabama University, Chennai-600119, Tamil Nadu**
**Email: +91-9444531114 amirdhashergill@gmail.com**

**Collaborator: Dr. S. Ganesamoorthy, Scientistific Officer-G,**
**Materials Science Group, DAE-IGCAR, Kalpakkam, Tamilnadu**
**Mobile: +91-9425313104; Email: ganesamoorthy@yahoo.com**

**Project Title :** Synthesis growth and characterization of Elpasolite scintillator single crystals and adaptation as Gamma ray detector

**Funding Agency : UGC-DAE CSR** **Year :** 2017-2020 **Amount :** Rs. 10.0 lakhs

**PI: Dr. K. Aravinth, Research Scientist, SSN Research Centre**
**SSN College of Engineering, Chennai-603 110, Tamilnadu**
**Mobile: +91-9677782199; Email: aravinth.nmg@gmail.com**

**Co-PI: Prof. P. Ramasamy, Dean (Research),**
**SSN College of Engineering, Chennai-603 110, Tamilnadu**
**Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in**

**Project Title :** Development of ultra low thermal conductivity high performance thermoelectric $TlBiSe_2$ and $TlBiS_2$ single crystals

**Funding Agency: SERB** **Year :** 2017-2020 **Amount :** Rs. 15.0 lakhs

**Dr. S.C. Gadkari, Outstanding Scientist and Head,**
**Technical Physics Division (TPD), Bhabha Atomic Research Centre (BARC),**
**Mumbai-400085, Maharastra**
**Mobile: +91-9869610060; Email: gadkari@barc.gov.in**

**Project Title :** Development of single crystals, detectors & imaging devices

**Funding Agency: BARC** **Year :** 2017 **Amount :** Rs. 1700 lakhs

**Project Title :** Technology Development for Indigenous Manufacturing of HPGe Detectors

**Funding Agency: BARC** **Year :** 2017 **Amount :** Rs. 1600 lakhs

**Dr. N. V. Giridharan, Assistant Professor,**
**Department of Physics, National Institute of Technology,**
**Tiruchirappalli-620015, Tamilnadu**
**Phone: +91-431-2503613**
**Email: giri@nitt.edu**

**Project Title :** Development of PZN-PT single crystal technology for naval transducer application

**Funding Agency: DRDO** **Year :** 2017-2020 **Amount :** Rs. 99.63 lakhs

**Dr. S. S. Islam, Centre for Nanoscience and Nanotechnology,**
**Jamia Millia Islamia, New Delhi-110025**
**Email: sislam@jmi.ac.in; safiul5996@gmail.com**

**Project Title :** Physical basis of domain engineering in piezoelectric single crystals of PMN-PT family and lead-free piezoceramics

**Funding Agency : DST-BRICS** **Year :** 2017-2020 **Amount :** Rs. 35.0 lakhs

**Dr. S.M. Ravi Kumar, Assistant Professor, PG and Research Department of Physics, Government Arts College, Tiruvannamalai-660603, Tamilnadu**
**Mobile: +91-8608953139; Email: smravi78@rediffmail.com**

**Project Title :** New potential material for infrared nonlinear optics: preparation and characterization of biometallic iodate $Mn_{0.75}Zn_{0.25}(Io_3)_2$

**Funding Agency : TNSCST** **Year :** 2017-2020 **Amount :** Rs. 10,000/=

**Dr. Rajni Kant, Professor, Post Graduate Department of Physics,**
**University of Jammu, Jammu Tawi-180006**
**Mobile: +91-9419194375**
**Email: rkant.ju@gmail.com**

**Project Title :** Investigation of growth, Crystal Structure and properties of some important organic materials

**Funding Agency : SERB** **Year :** 2017-2020 **Amount :** Rs.23.5 lakhs

**PI: Dr. N.P. Rajesh, Assistant Professor, Department of Physics,**
**SSN College of Engineering, Chennai-603110, Tamilnadu**
**Mobile: +91-9962086789; Email: rajeshnp@ssn.edu.in**

**Project Title :** Investigations on electrical and optical properties of pure and rareearth doped KTP single crystals

**Funding Agency : CSIR** **Year :** 2017-2020 **Amount :** Rs. 18.0 lakhs

**PI: Dr. P. Rajesh, Assistant Professor, Department of Physics,**
**SSN College of Engineering, Chennai-603110, Tamilnadu**
**Mobile: +91-9840522490; Email: rajeshp@ssn.edu.in**

**Co-PI: Prof. P. Ramasamy, Dean (Research),**
**SSN College of Engineering, Chennai-603110, Tamilnadu**
**Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in**

**Project Title :** Growth of Optical Quality Stilbene and Triphenyl Compounds for High-Energy Neutron Detection

**Funding Agency: SERB** **Year :** 2017-2020 **Amount :** Rs. 20.0 lakhs

**PI: Dr. G. Ramesh Kumar, Assistant Professor,**
**Department of Physics, University College of Engineering,**
**Anna University-Arni, Arni-632326, Tiruvannamalai District, Tamilnadu**
**Mobile: +91-9444275758**
**Email: rameshvandhai@gmail.com**

**Project Title :** Exploration of optical properties on irradiation induced defects in some amino acid single crystals

**Funding Agency: UGC-DAE CSR Year :** 2017-2020 **Amount :** Rs. 7.0 lakhs

**Dr. R. Santhakumari, Assistant Professor,**
**PG and Research Department of Physics, Government Arts College for Women (Autonomous), Pudukkottai-622001, Tamilnadu**
**Mobile: +91-9965586891**
**Email: santhasrinithi@yahoo.co.in**

**Project Title :** Synthesis, growth, structural, nonlinear optical and antibacterial studies on 4-hydroxy-3-methoxybenzaldehyde

**Funding Agency : TNSCST** **Year :** 2017-2019 **Amount :** Rs.4.05 lakhs

**Project Title :** Synthesis, growth, DFT and biological studies on some of the derivatives of aminopyridine

**Funding Agency : TNSCHE** **Year :** 2017 **Amount :** Rs.1.0 lakh

**PI: Dr. K. Srinivasan, Professor and Head, Department of Physics,**
**School of Physical Sciences, Bharathiar University,**
**Coimbatore-641 046, Tamil Nadu**
**Mobile: +91-9443609873**
**Email: nivas_5@yahoo.com**

**Project Title :** Investigation on the control of Liquid-Liquid Phase Separation (LLPS) and isolation of vanillin polymorphs for Industrial applications through novel crystallization techniques

**Funding Agency: CSIR** **Year :** 2017-2020 **Amount :** Rs. 12.90 lakhs

**Student Name: Ms. Apurva Gupta, Research Scholar**
**Mobile: +91-8373939663**
**Email: apurvagupta123@gmail.com**
**Guide Name: Dr. Lekha Nair, Professor**
**Department of Physics, Jamia Millia Islamia, New Delhi -110025**
**Mobile: 9810032194**
**Email: lnair@jmi.ac.in**

**Project Title :** Solution growth of organic non linear optical material and its irradiation effects

**Funding Agency : Inter University Accelerator Centre (IUAC)** **Year :** 2017

# INDIAN ASSOCIATION FOR CRYSTAL GROWTH

Centre for Crystal Growth, SSN Institutions,
Chennai-603110, Tamilnadu, INDIA
Mobile: +91-9283105760; 9944294169 Landline: 044-27469700
Email: iacgind@gmail.com
Website: http://www.ia-cg.com/

## IACG "PROF.P.RAMASAMY NATIONAL AWARD FOR CRYSTAL GROWTH"

## Norms for the Award

1. Any Indian Scientist who has contributed to the field of crystal growth is eligible for the award.
2. Any foreign scientist who has contributed to the development of crystal growth activities in India is eligible for the award.
3. Individual or Institution/Laboratory can be considered for the award.
4. Preference will be given to the crystal growth research carried out in India.
5. The research works carried out in the preceding five years of the year of award to be considered primarily for the award.
6. There is no age limit.
7. Self nomination/Nomination by the member of IACG/Nomination by an Institution can be accepted.
8. Scientist/Institution awarded once will be eligible for this award again only after five years from the date of previous award.
9. Award will be given once in two years, initially. Any more donation from any donor under same title is to be additive to the sum already donated and the award can be given annually.
10. The President, IACG may take the advice of the committee constituted by him for the purpose of selecting suitable awardee (s) and the decision of the President will be final.

## Recipients of Indian Association for Crystal Growth (IACG) "Prof. P. RAMASAMY National Award for Crystal Growth"

| Year | Name of the Recipients and Institutional Details |
|---|---|
| 2000 | **Dr. P. Santhana Raghavan**, *Managing Director,* GT Solar Corporation Limited, USA<br>**Dr. G. Dhanaraj**, *Scientist,* Department of Materials Sciences and Engineering, Stony Brook University, USA |
| 2002 | **Prof. R. Dhanasekaran**, *Emeritus Professor,* Crystal Growth Centre, Anna University, Chennai |
| 2003 | **Prof. M. Ichimura**, *Head,* Dept. of Electrical & Electronic Engg, Nagoya Institute of Technology, Japan |
| 2004 | **Prof. K. Sankaranarayanan**, *Professor*, Department of Physics, Alagappa University, Karaikudi |
| 2005 | **Dr. R. Gopalakrishnan**, Crystal Research Laboratory, Department of Physics, Anna University, Chennai |
| 2006 | **Prof. C. K. Mahadevan**, Physics Research Centre, Department of Physics, S.T. Hindu College, Nagercoil |
| 2007 | **Dr. N. Vijayan**, *Scientist*, X-ray analysis & Crystal Growth Section, National Physical Laboratory, New Delhi |
| 2008 | **Prof. S. Moorthy Babu**, *Director*, Centre for Nanoscience and Technology, Anna University, Chennai |
| 2009 | **Prof. K. Ramamurthi**, *Professor & Head*, Department of Physics, Bharathidasan University, Tiruchirappalli<br>**Dr. S. Ganesamoorthy**, *Scientific Officer-F*, LMDDD, RRCAT, Indore, Madhya Pradesh (M.P.) |
| 2010 | **Prof. G. Bhagavannarayana**, *Chief Scientist & Head,* Crystal Growth & X-ray Analysis Section, NPL, New Delhi<br>**Prof. S. Kalainathan**, *Director,* Centre for Crystal Growth, VIT University, Vellore |
| 2012 | **Dr. S. C. Gadkari**, *Outstanding Scientist and Head,* Crystal Technology Section, TPD, BARC, Mumbai |
| 2015 | **Prof. K. Byrappa**, *Vice-Chancellor,* Mangalore University, Karnataka<br>**Dr. A. K. Karnal**, *Scientific Officer-G, Crystal Growth Section,* LMDDD, RRCAT, Indore, Madhya Pradesh (M.P.) |
| 2017 | **Prof. Suja Elizabeth**, *Principal Research Scientist*, IISc, Bangalore, Karnataka |

# LIST OF CRYSTAL GROWTH (CG) RELATED JOURNALS WITH THOMSON REUTERS IMPACT FACTOR – JANUARY 2018

| Journal Name | IF |
|---|---|
| Applied Surface Science | 3.387 |
| Applied Physics A : Materials Science and Processing | 1.455 |
| Arabian Journal of Chemistry | 4.553 |
| Bulletin of Materials Science | 0.899 |
| Chinese Science Bulletin | 1.770 |
| Chemical Physics Letters | 1.815 |
| Crystal Growth and Design | 4.055 |
| Crystal Engineering Communication | 3.474 |
| Crystal Research and Technology | 0.880 |
| Current Applied Physics | 1.971 |
| Ferroelectrics | 0.530 |
| Japanese Journal of Applied Physics | 1.020 |
| Journal of Crystal Growth | 1.751 |
| Journal of Applied Crystallography | 2.614 |
| Journal of Alloys and Compounds | 3.133 |
| Journal of Physics and Chemistry of Solids | 2.059 |
| Journal of Physics D: Applied Physics | 2.588 |
| Journal of Solid State Chemistry | 2.299 |
| Journal of Physics: Condensed Matter | 2.649 |
| Journal of Materials Chemistry | 8.864 |
| Journal of Materials Science and Technology | 2.764 |
| Journal of Materials Science: Materials in Electronics | 2.019 |

| Journal Name | IF |
|---|---|
| Journal of Thermal Analysis and Calorimetry | 1.953 |
| Materials Letters | 2.572 |
| Materials Chemistry and Physics | 2.084 |
| Materials Research and Bulletin | 2.446 |
| Materials Science and Engineering A | 3.094 |
| Materials Characterizations | 2.714 |
| New Journal of Chemistry | 3.269 |
| Optical Materials | 2.238 |
| Optics Communications | 1.588 |
| Optics and Laser Technology | 2.109 |
| Optik- International Journal for Light and Electron Optics | 0.835 |
| Progress in Crystal Growth and Characterization of Materials | 3.400 |
| Physica B:Condensed Matter | 1.386 |
| RSC Advances | 3.108 |
| Results in Physics | 0.946 |
| Science of Advanced Materials | 1.400 |
| Solid State Communications | 1.554 |
| Solid State Science | 1.811 |
| Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy | 2.536 |
| Surface Science Letters | 2.062 |
| Synthetic Metals | 2.435 |
| The European Physical Journal of Applied Physics | 0.684 |

# SOME OF THE CRYSTAL GROWTH RESEARCH GROUPS

**Dr. N. Vijayan** and his Ph.D. students in X-Ray Analysis and Crystal Growth Section, National Physical Laboratory (NPL), New Delhi

**Dr. R. Ramesh Babu** and his Ph.D. Scholars in Crystal Growth & Thin Film Lab, Department of Physics, Bharathidasan University, Tiruchirappalli

**Dr. S. A. Martin Britto Dhas** and his Ph.D. students in Department of Physics, Sacred Heart College, Tirupattur, Tamilnadu

**Dr. J. Kalyana Sundar** and his Ph.D. students in Department of Physics, Periyar University, Salem, Tamilnadu

**Crystal Growth Researchers** at the Department of Physics, SRM University, Vadapalani Campus, Chennai, Tamilnadu

**Dr. S. Stephen Rajkumar Inbanathan** and his Crystal Growth Research Group in Department of Physics, The American College, Madurai, Tamilnadu

# GOVERNMENT FUNDING FOR EXTERNAL PROJECTS

1. **BRNS**- Regular Research Project (RP) (https://brns.res.in)
2. **BRNS**- Young Scientist's Research Award (YSRA) (https://brns.res.in)
3. **CSIR**- Research Grants (http://csirhrdg.res.in/resg/Res_grants.htm)
4. **DST**- Women Scientist Scheme- A (WOS-A) (www. online-wosa.gov.in)
5. **DST**- Women Scientist Scheme- B (WOS-B ) /Societal Research Fellowship (SoRF) (www.dst.gov.in/scientific-programmes/scientific-engineering-research/women-scientists-programs)
6. **DST**- Women Scientist Scheme- C (WOS-C) (www.dst.gov.in/scientific-programmes/scientific-engineering-research/women-scientists-programs)
7. **DST**- Scheme for Young Scientists and Technologists (www.dst.gov.in/callforproposals/call-proposals-scheme-young-scientists-and-technologists)
8. **DST**- Solar Energy Research Initiative (SERI) (http://www.dst.gov.in/clean-energy-research-initiative)
9. **DST**- INSPIRE FACULTY Scheme (www.inspire-dst.gov.in)
10. **DST**- Science for Equity, Empowerment & Development (SEED) Division (http://www.scienceandsociety-dst.org/Aboutscheme.htm)
11. **DST**- International Science & Technology co-operation (Indo-French, Indo-US & Indo-German) (http://www.dst.gov.in/international-st-cooperation)
12. **DST**- Sophisticated Analytical Instrument Facilities (http://www.dst.gov.in/scientific-programmes/scientific-engineering-research/sophisticated-analytical-instrument-facilities-saifs)
13. **DST**- Oriented Research & Technology Development Proposals on Materials for Energy Storage (MES) (http://www.dst.gov.in/)
14. **DST**- Water Technology Initiative (WTI-2017) for Water Technology Research and Innovation Centres (WATER-IC) (http://www.dst.gov.in/)
15. **DST**- **FIST** Program (www.fist-dst.org)
16. **DST**- Partnership for International Research and Education (PIRE) (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819)
17. **DSIR**- Technology Development and Utilization Programme for Women (TDUPW) (www.dsir.gov.in)
18. **DRDO**- Extramural Research Grant (http://www.drdo.gov.in)
19. **ISRO**- Submission of Research proposal (http://isro.gov.in/sponsored-research-respond/submission-of-research-proposal)
20. **MNRE**- Ministry of New and Renewable Energy (http://mnre.gov.in/schemes/solar-rd-projects/)
21. **NRB**- Naval Research Board (nrbdrdo.res.in)
22. **SERB**- Extra Mural Research Funding (Individual Centric) (http://www.serb.gov.in/emr.php)
23. **SERB**- Early Career Research (ECR) Award (http://serbonline.in/SERB/ecr?HomePage=New)
24. **SERB**- High Risk High Reward (http://www.serb.gov.in/hrhrr.php)
25. **SERB**- Women Excellence Award (www.serb.gov.in/women.php)
26. **SERB**- Empowerment and Equity Opportunities for Excellence in Science for SC/ST faculties (http://www.serb.gov.in/emeq.php)
27. **SERB**- Industry relevant Research and Development (http://serbonline.in/SERB/IRR?HomePage=New)
28. **TNSCST**- Science & Technology Projects (http://www.tanscst.nic.in/stp.html)
29. **UGC**- Start-up Grant (www.ugcfrps.ac.in)
30. **UGC**- Major and Minor Research Projects (www.ugcfrp.ac.in)
31. **UGC**- Mid-Career Award (www.ugcfrps.ac.in)
32. **UGC**- BSR Faculty Fellowships (www.ugcfrps.ac.in)
33. **UGC-DAE CSR** (http://www.csr.res.in/csr_indore_collaborative_research.html)

# FELLOWSHIPS AVAILABLE IN INDIA

1. **CSIR** - Senior Research Fellowship and RA (http://www.csirhrdg.res.in/jrfsrfra2.htm)
2. **CSIR** - Nehru Science Post Doctoral Research Fellowship (http://www.csirhrdg.res.in/npdf.htm)
3. **DAE** - Dr. K. S. Krishnan Research Associateship (KSKRA) (http://www.barc.ernet.in/)
4. **DST** - Ramanujan Fellowships (http://www.dst.gov.in/scientific-programme/nsti/ramanujanfellowship.pdf)
5. **DST** - JC Bose National Fellowships (http://www.dst.gov.in/scientific-programme/nsti/jc bosefellowship.pdf)
6. **DST**- Science, Technology & Innovation Policy Fellowship Programme (http://dst.gov.in/news/announcement-dst-science-technology-and-innovation-policy-fellowships)
7. **DST**-Bhaskara Advanced Solar Energy Fellowship Programme (http://indousstf.org/base-program/index.html)
8. **INSA** - Science Academies Summer Research Fellowship (http://www.insaindia.res.in/)
9. **INSA** - Visiting Fellowship (http://www.insaindia.res.in/)
10. **INSA**- Indo-Australia Early and Mid-Career Researchers (EMCR) Fellowship Programme (http://www.insaindia.res.in/)
11. **JSPS** - Japan Society for the Promotion of Science Fellowship Programs for Overseas Researchers (http://www.jsps.go.jp/english/e-fpo/index.html)
12. **JNMF** - Jawaharlal Nehru Memorial fellowship (http://www.jnmf.in/fabout.html)
13. **JNCASR** - Summer Research Fellowship Programme (http://www.jncasr.ac.in/fe/srfp.php)
14. **Lady Tata Memorial Trust** - Junior Scholarship and Post Doctoral Fellowship (PDF) (https://www.ladytatatrust.org/StaticPageIndia/Awards/7)
15. **MNRE** - National Solar Science Fellowship Programme (NSSFP) (www.mnre.gov.in)
16. **Raman Charpak Fellowship** (http://www.inde.campusfrance.org/en/news/charpak-scholarship-awardees-20132014)
17. **SERB** - Distinguished Fellowship (http://www.serb.gov.in/sdf.php)
18. **SERB** - Women Excellence Award (http://www.serb.gov.in/wea.php)
19. **SERB** - Overseas Post Doctoral Fellowship (http://www.serb.gov.in/opf.php)
20. **SERB** - National Post Doctoral Fellowship (http://www.serb.gov.in/npdf.php)
21. **SERB** - Indo - US Fellowship Program (http://serbonline.in/SERB/indous?HomePage=New)
22. **SERB** - SN Bose Scholar Program (http://serbonline.in/SERB/snbose?HomePage=New)
23. **SERB** - Graduate Student Exchange Programme (http://serbonline.in/SERB/gsep?HomePage=New)
24. **SERB** - Prime Minister's Fellowship Scheme for Doctoral Research (http://primeministerfellowshipscheme.in/Home.aspx)
25. **SERC –** Swarnajayanti Fellowships (http://www.dst.gov.in/scientific-programmes/scientific-engineering-research)
26. **TNSCST** - Young Scientist Fellowship Scheme (http://www.tanscst.nic.in/ysf.html)
27. **TIFR** - ICTS - Simons Post Doctoral Fellowship (PDF) (https://www.icts.res.in/opportunities/simons-pdf-sept-2016)
28. **UGC** -Post Doctoral Fellowship for Women Candidates (http://www.ugc.ac.in/pdfw/)
29. **UGC** -Post Doctoral Fellowship for SC/ST candidates (http://www.ugc.ac.in/pdfss/)
30. **UGC** - Rajiv Gandhi National Fellowship (RGNF) for SC/ST candidates (http://www.ugc.ac.in/rgnf/)
31. **UGC** - Dr. S. Kothari Post Doctoral Fellowship (http://www.ugc.ac.in/)
32. **UGC** - Raman Fellowship for Post Doctoral Research for Indian Scholars in USA (http://www.ugc.ac.in/ramanpdf/)
33. **UGC** - Maulana Azad National Fellowship for Minority Students (http://www.ugc.ac.in/)

# PAST CONFERENCES/SEMINARS/WORKSHOPS/SUMMER SCHOOLS

**Dr. V. N. Mani** giving Memento to **Prof. P. Ramasamy** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. V. N. Mani** giving Memento to **Prof. S. Moorthy Babu** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Prof. SP. Meenakshisundaram** giving Memento to **Dr. P. Murugakoothan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. C. Ramachandra Raja** giving Memento to **Dr. S. A. Martin Britto Dhas** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Brahadeesawarn** giving Memento to **Dr. R. Vidya** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. Muthu Senthil Pandian** felicitating **Dr. S. Jerome Das** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Jerome Das** giving Memento to **Prof. R. Jayavel** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Brahadeeswaran** giving Memento to **Dr. R. Arun Kumar** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Jerome Das** giving Memento to **Dr. M. Arivanandhan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. R. Mohan Kumar** giving Memento to **Dr. G. Vinitha** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Prof. D. B. Gadkari** giving Memento to **Dr. R. Ramesh Babu** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. V. N. Mani** giving Memento to **Prof. X. Sahaya Shajan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Pari** giving Memento to **Prof. Suja Elizabeth** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Brahadeeswaran** giving Memento to **Prof. S. Kalainathan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. R. Siva Kumar** giving Memento to **Prof. C. K. Mahadevan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Prof. D. B. Gadkari** giving Memento to **Dr. P. Rajesh** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. C. Ramachandra Raja** giving Memento to **Dr. P. Srinivasan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. S. Brahadeeswaran** giving Memento to **Prof. SP. Meenakshisundaram** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. Muthu Senthil Pandian** felicitating **Dr. R. Ramesh Babu** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. P. Murugakoothan** giving Memento to **Dr. U. Madhusoodanan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017


The release of abstract book in the NCRTFM-2017 held at Department of Physics, B.S.Abdur Rahman Crescent University, Chennai during 5-6th December 2017 organized by **Prof. I. B. Shameem Banu**

Prof. M. Muryala Naidu, Vice Chancellor, Adikavi Nannayya University presenting shawl to **Dr. K. Ramachandra Rao** in the inauguration ceremony of book release entitled Rare Earth doped NLO crystals during July 2017

**Dr. C. Ravidhas**, HOD, Department of Physics, Bishop Heber College, presenting shawl to **Prof. R. Chandramohan** in the RCMS-2017 held at Department of Physics, Sree Sevugan Annamalai College, Devakottai during 15th July 2017


**Dr. U. Madhussoodanan** receiving Memento from **Dr. R. Arun Kumar** in SRIP-2017 held at GRD Centre for Materials Research, PSG College of Technology, Coimbatore during 12-22st June 2017

The release of abstract book in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017 organized by **Dr. R. Ravisankar**

**Dr. N. Vijayan** receiving Memento for his special lecture from the organizer in Department of Physics, Saveetha School of Engineering during 18th August 2017 organized by **Dr. N. Sivakumar**

**Dr. R. Ramesh Babu** receiving memento from **Dr. R. Arun Kumar** in SRIP-2017 held at GRD Centre for Materials Research, PSG College of Technology, Coimbatore during 12-22st June 2017

**Dr. K. Ramachandra Rao** with Prof. G. Nageswararao, Vice Chancellor, Andhra University in inauguration of National Conference on Recent Materials in Physics and Chemistry held at SRR and CVR College, Vijayawada during October 2017


**Dr. Basheer Achamed** felicitating **Dr. Muthu Senthil Pandian** in the NCRTFM-2017 held at Department of Physics, B.S.Abdur Rahman Crescent University, Chennai during 5-6th December 2017 organized by **Prof. I. B. Shameem Banu**


The organizer presenting shawl to **Prof. K. Ramamurthi** in the SLSAMS-2018 held at Department of Physics, PSA College of Arts and Science, Dharmapuri during 11th January 2018 organized by **Dr. P. Kathiravan**

**Dr. R. Jayavel** delivering Invited Lecture in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017 organized by **Dr. R. Ravisankar**

The Convenor felicitating **Dr. K. Ramachandra Rao** in the AICTE Faculty Development Programme held at Narasaraopet Engineering College, Andhra Pradesh during September 2017

The release of Abstract Book in the ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai during 8-9th September 2017

**Dr. R. Arun Kumar** receiving Memento from the Convener in the NCAFMAE-2017 held at Department of Physics, Dr.NGP Institute of Technology, Coimbatore during 25th January 2017

**Dr. M. Selvapandian** felicitating **Dr. R. Ravisankar** in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017

**Dr. Muthu Senthil Pandian** presenting Crystal Display during his invited lecture in Department of Physics, Saveetha School of Engineering during 27th March 2017 organized by **Dr. N. Sivakumar**


Inaugural Function in NCPCCM-2017 held at PG & Research Department of Physics, Government Arts College, Tiruvannamalai during 5-6th September 2017 organized by **Dr. S. M. Ravi Kumar**

**Dr. Muthu Senthil Pandian** presenting Crystal Display during his invited lecture in SRIP-2017 held at GRD Centre for Materials Research, PSG College of Technology, Coimbatore during 12-22st June 2017

**Dr. K. Ramachandra Rao** receiving Memento in the NWBMBE-2017 held at Government College (Autonomous), Rajahmundry, Andhra Pradesh (A.P.) during 19-20th December 2017

**Prof. S. Moorthy Babu** receiving Memento from the Principal, Jeppiaar Institute of Technology, Chennai in the RDAM-2017 held at Department of Physics during 19th July 2017 organized by **Dr. V. Kannan**


**Dr. R. Arun Kumar** giving certificate to **Dr. M. D. Kannan** for his Invited Lecture in SRIP-2017 held at GRD Centre for Materials Research, PSG College of Technology, Coimbatore during 12-22st June 2017


Inaugural Function in the SLSAMS-2018 held at Department of Physics, PSA College of Arts and Science, Dharmapuri during 11th January 2018 organized by **Dr. P. Kathiravan**

The Secretary, Pachamuthu College of Arts and Science for Women, Dharmapuri handing over the Memento to **Prof. R. Jayavel** in the ICMAST-2017 held at Department of Physics during 28-29th August 2017

**Prof. P. Ramasamy** handing over the Memento to **Prof. S. Gunasekaran** in the ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai during 8-9th September 2017

**Prof. S. Moorthy Babu** giving Memento to **Prof. P. Ramasamy** in the ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai during 8-9th September 2017

**Prof. S. Moorthy Babu** in the Inaugural Function of SLSAMS-2018 held at Department of Physics, PSA College of Arts and Science, Dharmapuri during 11th January 2018 organized by **Dr. P. Kathiravan**


The release of Abstract Book in the NCRAMS-2017 held at Centre for Crystal Growth, VIT University, Vellore during 9-11th October 2017 organized by **Prof. S. Kalainathan**

**Dr. R. Arun Kumar** giving Hands on Training to the Crystal Growth researchers in the GRD Centre for Materials Research, PSG College of Technology, Coimbatore in SRIP-2017 during 12-22st June 2017

**Prof. P. Ramasamy** in the inaugural function of ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai, Tamilnadu during 8-9th September 2017

**Prof. P. Ramamurthy** distributed certificate in Academies Lecture Workshop held at Department of Physics, Periyar University PG Extension Centre, Dharmapuri during 13th October 2017


**Dr. P. Selvarajan** receiving Memento in the NCRAMS-2017 held at Centre for Crystal Growth, VIT University, Vellore during 9-11th October 2017 organized by **Prof. S. Kalainathan**

The organizers felicitating **Dr. Muthu Senthil Pandian** in the NCRAMS-2017 held at Department of Physics, Government Arts College, Tiruvannamalai during 25-26th July 2017


**Prof. K. Porsezian** distributed certificate in National Workshop on Advanced Materials held at Department of Physics, Periyar University PG Extension Centre, Dharmapuri during 23rd February 2017

**Dr. R. Balasundara Prabhu**, **Dr. R. Arun Kumar**, **Dr. S. Prasanna** and other organizers in NCAM-2017 held at Department of Physics, PSG College of Technology, Coimbatore during 12-13th December 2017

**Dr. Sunil Verma**, Scientific Officer-G, RRCAT and the Crystal Growth researchers in NLS-2017 held at BARC, Mumbai during 20-23rd December 2017

The organizers felicitating **Prof. P. Ramasamy** in the ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai during 8-9th September 2017


**Dr. M. Selvapandiyan** honoured **Prof. C. K. Jayasankar** with shawl and Memento in National Workshop on Advanced Materials at Periyar University PG Extension Centre, Dharmapuri on 23rd February 2017

**Dr. S. Brahadeeswaran** organized International Conference on Advances in Biological, Chemical and Physical Sciences(ABCPS-17) at Department of Physics, BIT-Anna University, Tiruchirappalli during 14-16th March 2017

**Dr. S. Jerome Das** in the inaugural function of NCAMAP-2017 held at Department of Physics, Adhiyaman Arts and Science College for Women, Uthangarai, Krishnagiri during 24th August 2017

**Dr. Muthu Senthil Pandian** receiving Memento from the Principal, Jeppiaar Institute of Technology, Chennai in the RDAM-2017 held at Department of Physics during 19th July 2017 organized by **Dr. V. Kannan**

# INDIAN ASSOCIATION FOR CRYSTAL GROWTH

**SSN Research Centre, SSN Institutions,**
**Kalavakkam, Chennai-603110, Tamilnadu, INDIA**
**Mobile: +91-9283105760; 9944294169 Landline: 044-27469700**
**Email: iacgind@gmail.com**
**Website: http://www.ia-cg.com/**

**Prof. P. Ramasamy**
Dean (Research)
SSN College of Engineering
Chennai
**President**

**Prof. S. Moorthy Babu**
Director
Centre for Nanoscience & Technology
Anna University, Chennai
**Treasurer**

**Dr. Muthu Senthil Pandian**
Department of Physics
SSN Research Centre, SSN CE
Chennai
**Editor, IACG News Letter**

## Executive Committee Members

- **Dr. Bansi Lal**, Professor, IIT Kanpur, Uttar Pradesh (U.P.)
- **Dr. Bamzai. K.K**, Professor, Crystal Growth Laboratory, University of Jammu, Jammu
- **Dr. Binay Kumar**, Professor, Crystal Lab, University of Delhi, New Delhi
- **Dr. Bhagavannarayana. G**, Director, RGUKT-IIIT, Andhra Pradesh (A.P.)
- **Dr. Byrappa. K**, Vice-Chancellor, Mangalore University, Karnataka
- **Dr. Das. S.K**, Department of Physics, KIIT University, Odisha
- **Dr. Ganesamoorthy**. S, Scientific Officer-G, X-ray Scattering & Crystal Growth Section, IGCAR
- **Dr. Gadkari. S.C**, Outstanding Scientist & Head, Crystal Technology Section, BARC, Mumbai
- **Dr. Jayavel. R**, Director (Research), Crystal Growth Centre, Anna University, Chennai
- **Dr. Karnal. A.K**, Scientific Officer-G & Head, Crystal Growth Section, RRCAT, Indore, M.P.
- **Dr. Kalainathan. S**, Director, Centre for Crystal Growth, VIT University, Vellore
- **Dr. Mihir. J. Joshi**, Professor, Saurashtra University, Gujarat
- **Dr. Suja Elizabeth**, Principal Scientist, IISc, Bangalore
- **Dr. Sunil Verma**, Scientific Officer-G, Crystal Growth Section, LMDDD, RRCAT, Indore, M.P.
- **Dr. Sankaranarayanan. K**, Professor, Crystal Growth Lab, Alagappa University, Karaikudi
- **Dr. Thamizhavel. A**, Principal Scientist, Crystal Growth Laboratory, TIFR, Mumbai
- **Dr. Vijayan. N**, Scientist, Crystal Growth Section, National Physical Laboratory, New Delhi

# HONORS/AWARDS

**Dr. R. Ramesh Babu** receiving Memento from **Prof. P. Ramasamy** in the ICRAST-2017 held at Centre for Nanoscience & Technology, Anna University, Chennai during 8-9th September 2017

**Prof. G. Bhagavannarayana** felicitating **Dr. P. Murugakoothan** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. V. N. Mani** giving Memento to **Prof. Narayana Kalkura** in the XXI National Seminar on Crystal Growth & Applications (XXI NSCGA-2017) held at National College, Trichy during 6-8th March 2017

**Dr. N. Vijayan** receiving Memento in the National Conference on Recent Advances in Materials Science & Nanotechnology (RAMN-2017) held at Department of Physics, AMET University during 26-27th May 2017

**Dr. S. Brahadeeswaran** giving Memento to **Dr. C. Ramachandra Raja** in the XXI NSCGA-2017 held at National College, Trichy during 6-8th March 2017

**Dr. G. Anbalagan** giving Memento to **Dr. R. Mohan Kumar** in the XXI NSCGA-2017 held at National College, Trichy during 6-8th March 2017

# India-Made DS Crystal Growth Equipment in SSN Research Centre


Silica Crucible inside the graphite retort

Si Feed stock Loaded crucible

mc-Si grown by DS process

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