INDIAN ASSOCIATION FOR CRYSTAL GROWTH

Since 1982

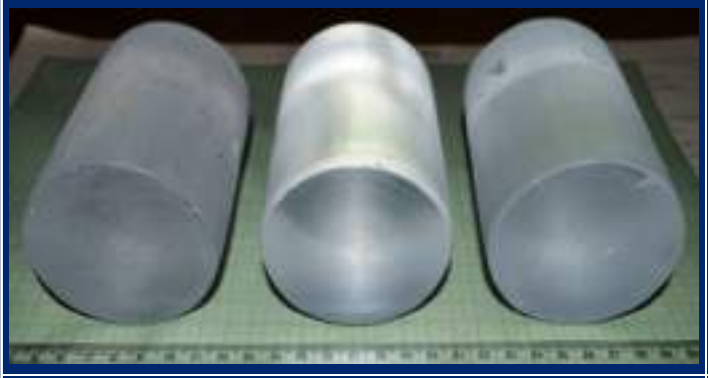
IACG NEWS LETTER

http://www.ia-cg.com/

YEARLY BULLETIN OF CRYSTAL GROWTH RESEARCH AND APPLICATIONS | February 2020 | Issue 32

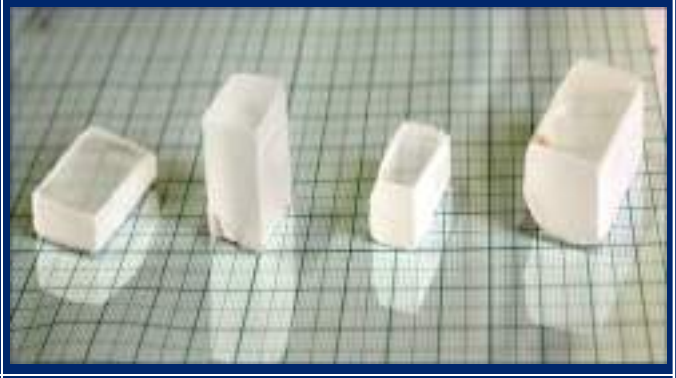
Cut and polished CsI:Tl single crystal for Detector Applications

CRYSTAL TECHNOLOGY SECTION, TPD, BARC



Fabricated Trans-stilbene crystal elements for Neutron Detector Applications

OPTICAL COMPOSITE MATERIALS LAB, RRCAT



As grown $Cd_{0.9}Zn_{0.1}Te$ (CZT) crystal for Gamma Radiation Detector Applications

MATERIALS SCIENCE GROUP, IGCAR

Large size (2.7 kg) flat-top KDP crystal for Nonlinear Optical (NLO) Applications

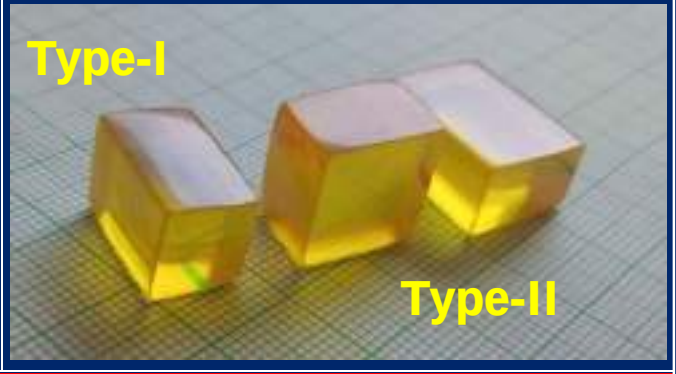
CRYSTAL GROWTH SECTION, LFMD, RRCAT

Single crystal of 2"×2" LiI:Eu for Thermal Neutron Detection Applications

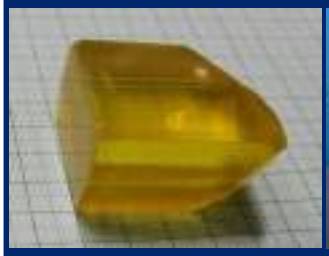
CRYSTAL TECHNOLOGY SECTION, TPD, BARC

Fabricated Type-I and Type-II 2AP4N SHG Elements for Optical Applications

SSN RESEARCH CENTRE, SSN INSTITUIONS



RECENTLY GROWN TECHNOLOGICALLY IMPORTANT SINGLE CRYSTALS



2AP4N - T. Kamalesh
P. Ramasamy, SSNI

β-Ga_2O_3-S.Moorthy Babu
Anna University

Trans-Stilbene - Sujan Kar
Sunil Verma, RRCAT, Indore

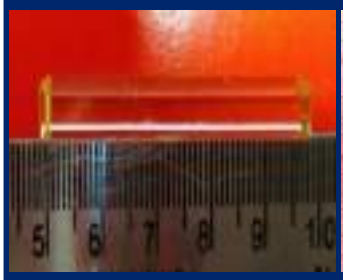
TPB-K. Sankaranarayanan
Alagappa University

Nd:$GdVO_4$ - A.K. Karnal
RRCAT, Indore

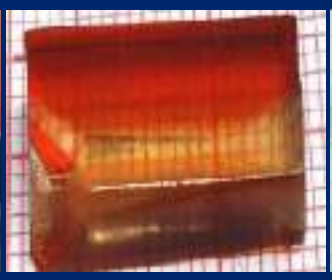
CsI:Tl - Shashwati Sen
TPD, BARC

Halide Crystals - Binay
Kumar, University of Delhi

BNA - K. Srinivasan
Bharathiar University



IDA - N. Vijayan
NPL, New Delhi



GuAB-P. Murugakoothan
CKN College, Chennai

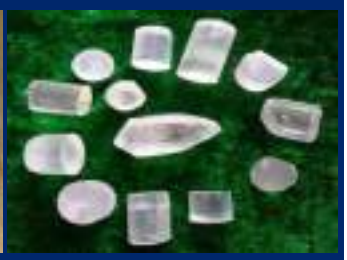
Eu:LiI - Mohit Tyagi
TPD, BARC

SrI_2:Eu - S.C. Gadkari
BARC, Mumbai

LS:KDP - R. Arun Kumar
NIT, Andhra Pradesh

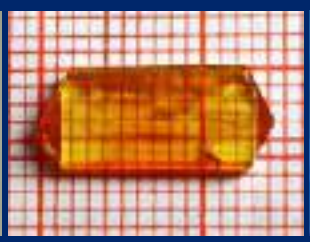
2.7 kg KDP - S. K. Sharma
RRCAT, Indore

CZT - S. Ganesamoorthy
IGCAR, Kalpakkam



3PB - S. Kalainathan
VIT, Vellore

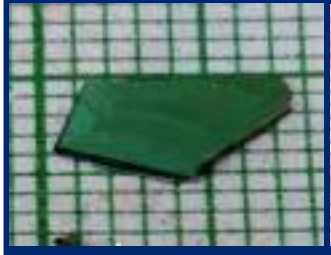
Nd-Cr:YVO_4 - Indranil
Bhaumik, RRCAT, Indore



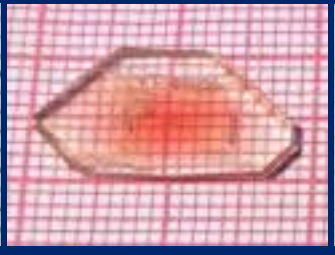
8HQ2C5N-G. Anbalagan
Madras University

LLDP - R. Ramesh Babu
Bharathidasan University

Stilbene - K. Sethuraman
MK University



DAST - S.A. Martin
Britto Dhas, Sacred Heart



PTM - R. Mohan Kumar
Presidency College

SR - 4NP - P. Karuppasamy
Muthu Senthil Pandian, SSNI

Mg:SA - M. Selvapandiyan
Periyar University

CONTENTS

IACG NEWS LETTER
February 2020 | Issue-32
http://www.ia-cg.com/

PREVIOUS FIVE ISSUES - IACG NEWS LETTERS

EDITORIAL MESSAGE

It is a great pleasure for me to present you the 32nd issue of IACG NEWS LETTER, February-2020. An enthusiastic note is that the number of the Crystal Growth members is increasing tremendously. To date we have about 650 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 32nd Issue of our IACG News Letter-2020. 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 is increasing day-by-day. This year alone 15 Crystal Growth research projects have been sanctioned for about **12.67 crore** to our IACG members from **DST, SERB, DRDO, CSIR, UGC-DAE CSR** and **TNSCST**. 47 Ph.D. theses have been submitted/completed in Crystal Growth during 2019. Several Crystal Growth researchers have got National Fellowship like **SERB-OVSF, CSIR-Emeritus, Full Bright Fellowship, DST-WOS-A, UGC-DSK, INSA-Visiting Scientist Fellowship, INSA-FASAF and INSA-SRF** to work in various reputed National research laboratories and universities. Many of our researchers have got IACG-Prof.P.Ramasamy National Award for Crystal Growth, MRSI Award, LEAP Award, Life Time Achievement Award, Young Scientist Award, Bharat Excellence Award, Best Researcher Award, ISPA Awards, Best Research Contribution Award, Best Crystal Display Award and Best Paper Presentation Awards for their outstanding work in Crystal Growth.

IACG has successfully organized TWENTY THREE 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). XXIII NSCGA-2019 was organized at Department of Physics, Bharathiar University, Coimbatore, Tamilnadu during 28-30 January 2019. Several eminent scientists in India and **Prof. Feffrey.J. Derby, Editor, Journal of Crystal Growth (JCG)** participated and delivered their lecture in this seminar. The XXIII NSCGA-2019 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 and its Applications. To recognize Dr. R. Gopalakrishnan's research contribution, **"Dr. R. Gopalakrishnan National Award for Best Thesis in Crystal Growth"** was introduced by IACG in 2016. The young researchers who submitted thesis in Crystal Growth and Applications within the previous one year period are eligible to apply for this award. Mr. V. Govindan, Alagappa University, Karaikudi Mr. P. Sampath Kumar, Bharathiar University, Coimbatore and Mr. S. Kotteswaran, SSN Institutions, Chennai received this Award in 2019.

NSCGA is held in different cities as annual event. This year it is being organized at Department of Physics, Periyar University, Salem, Tamil Nadu during 3-5 February 2020. The present "XXIV National Seminar on Crystal Growth and Applications (NSCGA-2020)" is a major event for us involving several Senior and Young Scientists. The current seminar includes 35 Invited Lectures, 18 Dr.RG National Award for Best Thesis in CG presentations, 14 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

Crystal Growth Seminars organized by Indian Association for Crystal Growth (IACG)

The **"Silver Jubilee Seminar"** of *25th National Seminar on Crystal Growth & Applications (XXV NSCGA-2021)* will be hosted by **Prof. K. Sankaranarayanan**, Dean (Science) and **Prof. G. Ravi**, Head at Department of Physics, Alagappa University, Karaikudi-630003, Tamil Nadu in 2021.

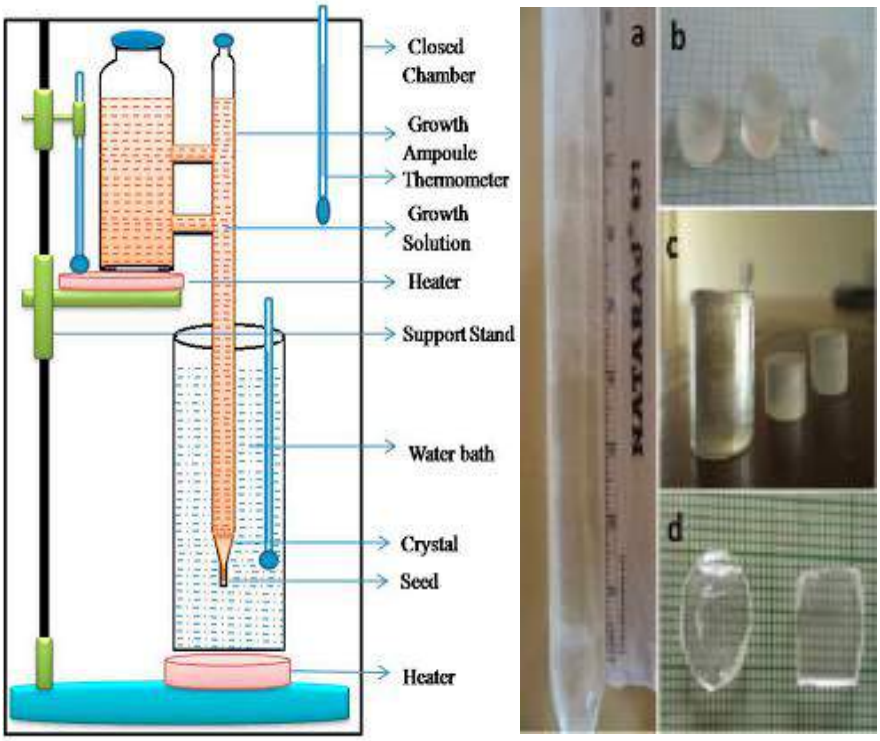
No	Name of the Programme	Place	Period
1	**1st** National Seminar on Crystal Growth **(NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	4-6 October **1982**
2	**2nd** National Seminar on Crystal Growth **(II NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	27-30 August **1983**
3	**3rd** National Seminar on Crystal growth **(III NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	16-19 February **1987**
4	**4th** National Seminar on Crystal Growth **(IV NSCG)**	University of Mysore Mysore-570005, Karnataka	3-6 August **1989**
5	**5th** National Seminar on Crystal Growth **(V NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	18-20 November **1993**
6	**6th** National Seminar on Crystal Growth **(VI NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	12-15 February **1995**
7	**7th** National Seminar on Crystal Growth **(VII NSCG)**	Department of Physics, Alagappa University, Karaikudi-630003, Tamil Nadu	6-8 January **1997**
8	**8th** National Seminar on Crystal Growth **(VIII NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	3-5 February **1999**
9	**9th** National Seminar on Crystal Growth **(IX NSCG)**	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu	24-26 February **2003**
10	**10th** National Seminar on Crystal Growth **(X NSCG)**	Department of Physics, Kongu Engineering College, Erode-638052, Tamil Nadu	27-29 January **2005**
11	**11th** National Seminar on Crystal Growth **(XI NSCG)**	Centre for Crystal Growth SSN CE, Chennai-603110, Tamil Nadu	7-9 December **2006**
12	**12th** National Seminar on Crystal Growth **(XII NSCG)**	Centre for Crystal Growth SSN CE, Chennai-603110, Tamil Nadu	21-23 December **2007**
13	**13th** National Seminar on Crystal Growth **(XIII NSCG)**	Centre for Crystal Growth SSN CE, Chennai-603110, Tamil Nadu	27-29 January **2009**
14	**14th** National Seminar on Crystal Growth **(XIV NSCG)**	Centre for Crystal Growth VIT University, Vellore-632014, Tamil Nadu	10-12 March **2010**
15	**15th** National Seminar on Crystal Growth **(XV NSCG)**	PSN College of Engineering Tirunelveli-627152, Tamil Nadu	23-25 February **2011**
16	**16th** National Seminar on Crystal Growth **(XVI NSCG)**	Department of Physics, Aditanar College of Arts & Science, Tiruchendur-628216	19-21 January **2012**
17	**17th** National Seminar on Crystal Growth **(XVII NSCG)**	Department of Physics, Anna University, Chennai-600025, Tamil Nadu	9-11 January **2013**
18	**18th** National Seminar on Crystal Growth **(XVIII NSCG)**	Centre for Crystal Growth, SSN College of Engineering, Chennai-603110, Tamil Nadu	24-26 February **2014**
19	**19th** National Seminar on Crystal Growth **(XIX NSCG)**	Centre for Crystal Growth, VIT University, Vellore-632014, Tamil Nadu	12-14 March **2015**
20	**20th** National Seminar on Crystal Growth & Applications **(XX NSCG)**	Bhabha Atomic Research Centre (BARC) Mumbai-400094, Maharastra	19-21 January **2016**
21	**21st** National Seminar on Crystal Growth & Applications **(XXI NSCGA)**	Department of Physics, National College, Tiruchirappalli-620001, Tamil Nadu	6-8 March **2017**
22	**22nd** National Seminar on Crystal Growth & Applications **(XXII NSCGA)**	Department of Physics, Sacred Heart College, Tirpattur-635601, Tamil Nadu	29-31 January **2018**
23	**23rd** National Seminar on Crystal Growth & Applications **(XXIII NSCGA)**	Department of Physics, Bharathiar University, Coimbatore-641046, Tamil Nadu	28-30 January **2019**
24	**24th** National Seminar on Crystal Growth & Applications **(XXIV NSCGA)**	Department of Physics, Periyar University, Salem-636011, Tamil Nadu	3-5 February **2020**

SANKARANARAYANAN-RAMASAMY (SR) METHOD OF CRYSTAL GROWTH

Enhancement of the growth rate of the crystal in TG-SR Method

V. Govindan, K. Sankaranarayanan*
Department of Physics, Alagappa University, Karaikudi-630003, Tamil Nadu, India

The principle of this method involves a temperature gradient between the nutrient zone (let, the temperature be T_1) and the growth zone (let the temperature be T_2). Usually the temperature $T_1 > T_2$ to ensure the solute transport to the seed either by natural or forced convection and owing to the temperature difference the solution becomes supersaturated and the growth occurs on the seed surface. In TG-SR method, the unidirectional growth along a specified crystallographic direction is feasible due to the single crystal seed which is kept at the bottom of the ampoule. In the present experimental set-up, the temperature driven flow directs the growth units towards the seed with the aid of gravity induced flow regimes. A typical arrangement for temperature gradient SR method with bottom seeding is shown in Figure.1. Using this set-up, the triphenylmethane (TPM) unidirectional single crystal was grown successfully for the potential application in the detection of high energy particle [1].



In the case of unidirectional growth of crystals from solution, several papers on the SR method for growing different organic single crystals were found. Current interest among the researchers is to improve the size as well as to achieve transparent high quality cylindrical shaped crystals from the SR method for several applications. Only very few studies are available on the growth of material like TPM because of the difficulty in achieving reasonable size crystals from conventional solution and melt methods.

Figure.1 *Schematic diagram of SR Experimental Setup,* ***(a)*** *SR method grown TPM single crystal with glass ampoule* ***(b)*** *Sliced TPM crystal and* ***(c & d)*** *Polished ingots of TPM crystal*

Attempts made by us to grow the studied material by conventional solution methods, including SR method have yielded small crystals with habituated morphology. Generally the temperature gradient solution method has the capability of producing large size multifaceted single crystals irrespective of technical limitations in transferring the mother liquor through different zones without favoring multinucleations. But it favors defects over the surface of the crystals due to its forced convection flow in the growth zone. Fig. 2 depicts the experimental growth apparatus of the temperature gradient SR crystal growth system. It features two hot zones and two cold zones, which can be kept at the desired temperatures with the aid of a temperature controller within ± 0.5 ºC.

Figure. 2 depicts the experimental growth apparatus of the temperature gradient SR crystal growth system. It features two hot zones and two cold zones, which can be kept at the desired temperatures with the aid of a temperature controller within ± 0.5 ºC. The zones are connected through tubes which facilitate the natural convection driven by the temperature gradient across the two zones. For a given solution with defined physicochemical characteristics, the convective flow velocity largely depends on the temperature gradient which ultimately dictates the growth rate of the crystal through the supply of growth units. The occurrence of the growth units in the cold/growth zone is directed towards the growth interface by the gravity. The constant supply of the growth units to the interface is ascertained through the observation on the elevation of the interface. The temperature gradient was fixed based on the experimental parameters like a solvent and its volume, concentration of the solute and the seed. The successful application of this set-up felicitated the growth of a unidirectional 1,3,5 triphenylbenzene (TPB) at a much faster growth rate than the previous experimental set-up as shown in figure 1.

An efficient crystal growth set-up was designed in order to overcome the limitation in the growth of large single crystals of TPB by conventional slow solvent evaporation technique. The success of the utilization and the repeatability of the newly developed experimental set-up were demonstrated with the unidirectional growth of cylindrical shaped TPB crystals having suitable dimensions for optical applications. Further, FWHM values of the DC curve recorded on unidirectionally grown crystal indicate that the grown crystal has reasonable crystalline perfection. This suggested that further optimization of the experimental parameters is essential to improve the crystalline perfection. FTIR and Micro-Raman studies identified the basic functional groups in the molecular structure and their characteristic vibrations of the grown material. The etching studies has revealed the layered growth and established the applicability of the etchant to analysis the grown-in defects in TPB. The scintillation properties were assessed from radio luminescence spectral analysis. The comparable thermophysical data with standard optical material justify the application of TPB in photonics.

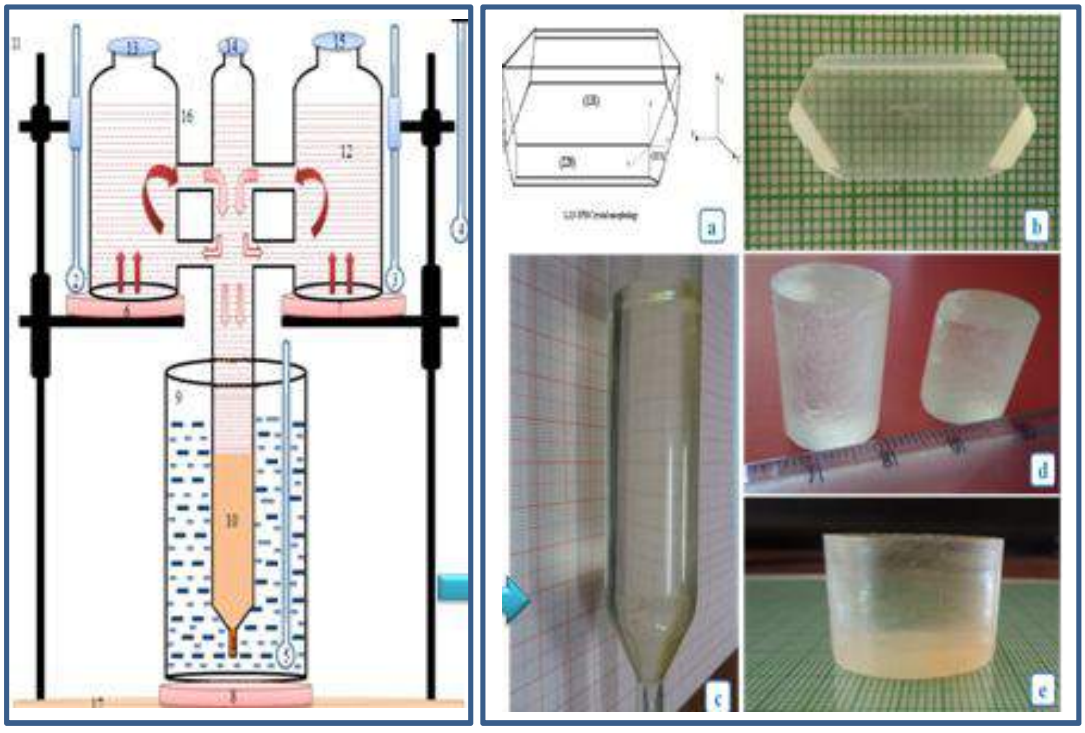


Figure 2. *Temperature Gradient (TG)-SR experimental set-up for enhanced growth rate.* ***Figure.2 (a)*** *Morphology of TPB crystal,* ***(b)*** *Conventional method grown 1,3,5-TPB* ***(c)*** *TG-SR method grown TPB crystal with glass ampoule* ***(d and e)*** *Cut and polished TPB wafers grown by TG-SR method*

Reference

1. V. Govindan et. al, Mater. Chemistry & Physics, Volume 223, 1 February 2019, Pages 183-189.

Growth of high quality 4-nitrophenol derivative single crystals by a novel Rotational Sankaranarayanan-Ramasamy (RSR) and RT-SR methods

P. Karuppasamy*, T. Kamalesh, Muthu Senthil Pandian, P. Ramasamy, Sunil Verma[a]
SSN Research Centre, SSN Institutions, Chennai-603110, Tamil Nadu, India
[a]Laser & Functional Materials Division, RRCAT, Indore-452013, Madhya Pradesh, India

The good quality 2-aminopyridinium 4-nitrophenolate 4-nitrophenol (2AP4N) single crystals have been grown by (i) Rotational Sankaranarayanan–Ramasamy (RSR) method and (ii) Roto-translation Sankaranarayanan–Ramasamy (RT-SR) method. The effect of rotation on unidirectional crystal growth method (RSR) has been reported for the first time. The apparatus was specially designed and developed for the growth of high-quality crystals by slow cooling under rotational conditions. The high-quality crystals have been achieved under forced convection and the quality of the crystal is compared to the crystals grown under free convection conditions. The results obtained from the SR and RSR method grown 2AP4N crystals were compared. The RSR method grown crystal has higher optical transparency, higher photoluminescence, higher photoconductivity, higher mechanical strength, higher laser damage threshold, higher crystalline perfection, less dislocation density, low dielectric loss and low full with at half maximum (FWHM). The second harmonic generation (SHG) of 2AP4N was analyzed by Kurtz-Perry powder technique. The SHG efficiency was found to be 4.5 times that of reference potassium dihydrogen phosphate (KDP) material.

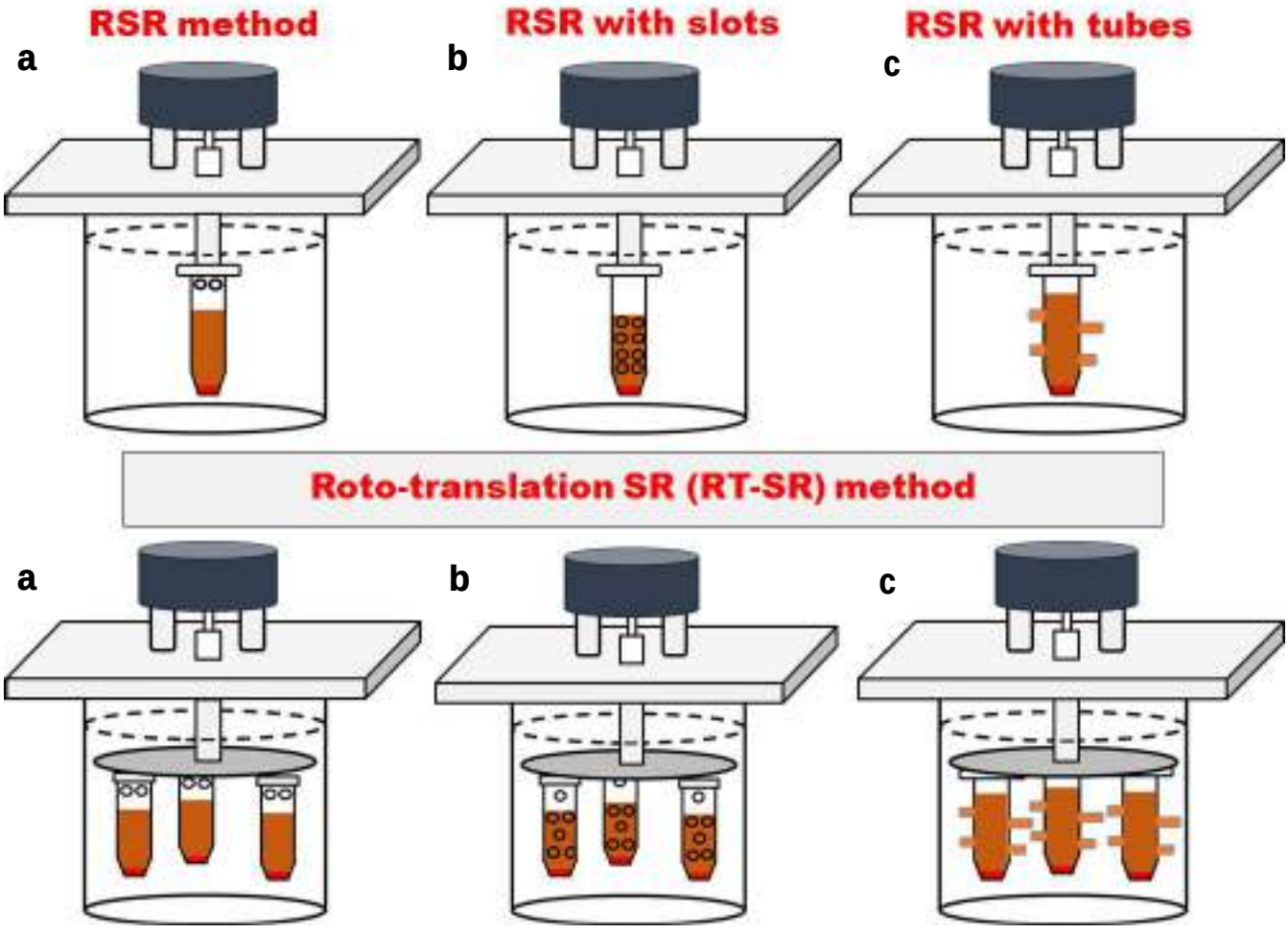


Figure.1 *Schematic diagram of* ***(a)*** *RSR,* ***(b)*** *RSR method with slots and* ***(c)*** *RSR method with tubes,*
Figure.2 *Schematic diagram of* ***(a)****RT-SR,* ***(b)*** *RT-SR method with slots and* ***(c)*** *RT-SR with tubes*

In our novel method, coupling both Sankaranarayanan-Ramasamy (SR) and point seeded rotational technique emerges new technique of RSR method. It gives the better crystal quality compared to the SR method grown crystal. Several modifications have been made in SR method and the details are available in the literature. But in all the modifications the main problem is segregated impurities. Because of the rotation, the segregated impurities are continuously pushed out due to the centrifugal force. In our RSR method, it gives the best solution to avoid this problem and also added all the advantages of SR method.

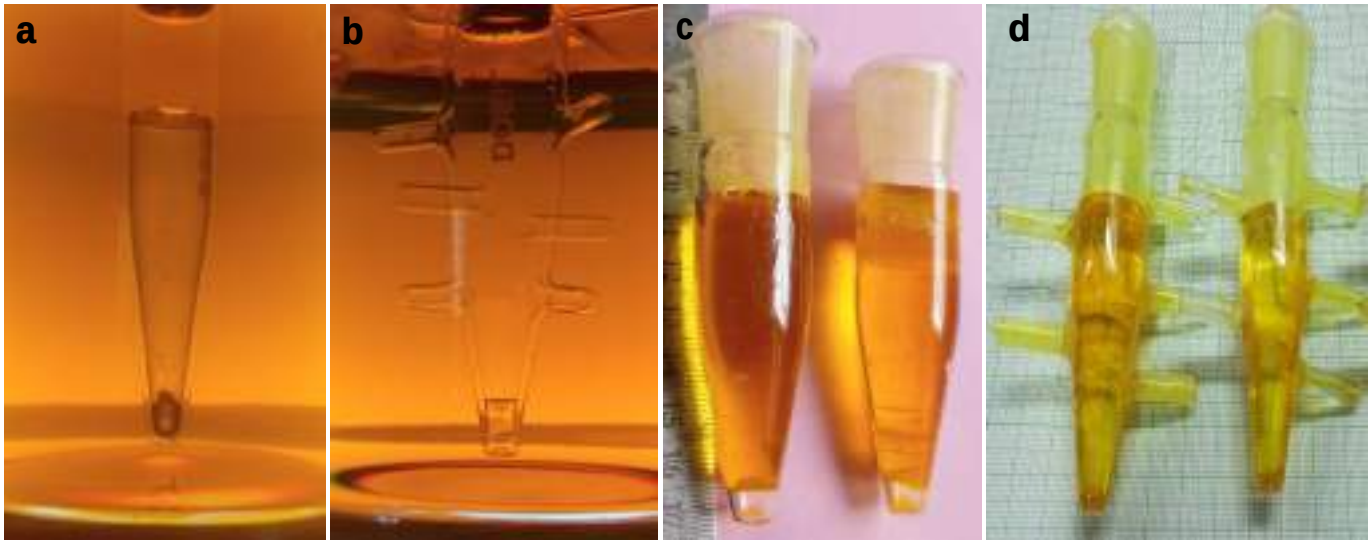


Figure.3 *2AP4N crystal growing (inside the glass ampoule)by RSR method* ***(a)*** *with slots and* ***(b)*** *with tubes,* ***(c)*** *2AP4N crystal grown by RSR methods* ***(d)*** *2AP4N crystals grown by RT-SR method*

The principal refractive indices of a 2-aminopyridinium 4-nitrophenolate 4-nitrophenol (2AP4N) crystal have been measured by a prism coupling method for the wavelengths of 0.532, 0.828, 1.064 and 1.551 μm at room temperature, and Sellmeier's coefficients are determined from the fitting of the data point. Refractive indices of the grown crystal were measured on a prism coupler spectrometer. The refractive indices as a function of wavelength can be described by using Sellmeier's equation. The measured wavelength-dependent refractive indices data were fitted by the method of least squares to Sellmeier's dispersion relation. The Sellmeier's equation was solved by using MATLAB code with inputs of Sellmeier co-efficient. On the basis of the Sellmeier equations, the phase-matching angles (θ_m) for 2AP4N crystal can be calculated. Type-I phase matching angle for 2AP4N single crystal in XZ plane ($\theta_m > V_z$) is θ_m=68.5º, (ϕ_m=0) and Type-II phase matching angle for this crystal in XZ plane ($\theta_m > V_z$) is θ_m=57.7º (ϕ_m=0). Therefore, the 2AP4N single crystal was cut in the XZ plane along the Y-axis. The Type-I and Type-II phase matching elements are shown in Figure.4 (b) and (c).

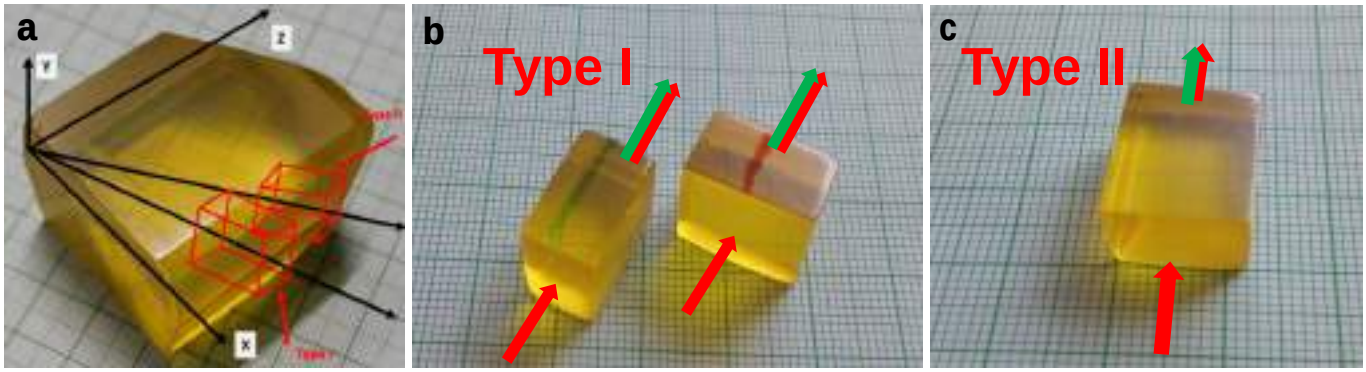


Figure.4 (a) *Bulk grown 2AP4N single crystal and Fabricated* ***(b)*** *Type-I and* ***(c)*** *Type-II SHG elements*

CHARACTERIZATION FACILITIES: AVAILABILITY IN INDIA

Single Crystal X-Ray Diffraction (SXRD)	
Bharathiyar University, Coimbatore, Tamilnadu	Dr. K. Srinivasan, Professor and Head, Department of Physics, Bharathiar University, Coimbatore-641046, TN, Mobile: +91-9443609873 Email: nivas_5@yahoo.com
Madurai Kamaraj (MK) University, Madurai	Dr. K. Anitha, Head (i/c), Department of Physics, MK University, Madurai-625021, TN, 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, Department of Physics, University of Jammu, Mobile: +91-9419194375; Tel/Fax: +91-191-2432051; Email: rkant.ju@gmail.com
Cochin University of Science and Technology	Cochin University of Science and Technology (CUST), Kerala http://www.sticindia.com/saif_instruments.html
Mahatma Gandhi (MG) University, Kerala	Prof. C. Sudarsankumar, School of Pure and Applied Physics, MG University, Kottyam-686560, Kerala, Mobile: +91-9447141561; Email: scxrdmgu@yahoo.com
Powder X-Ray Diffraction (PXRD)	
Alagappa University Karaikudi	Dr. Venkataraman Dharuman, Alagappa University, Mobile: +91-9865679897; Email: dharumanudhay@yahoo.com;
IIT Madras, Chennai Tamilnadu	Dr. P. K. Sudhadevi Antharjanam, Technical Officer, IIT Chennai, Tamilnadu 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. Email: nanofacilities@srec.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
Nirmalagiri College Nirmalagiri, Kerala	Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939; mail: nygill@gmail.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, Email: nanofacilities@srec.ac.in
St. Joseph College Tiruchirappalli	Dr .S. John Britto, Director, St. Joseph College, Trichy, Tamilnadu 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

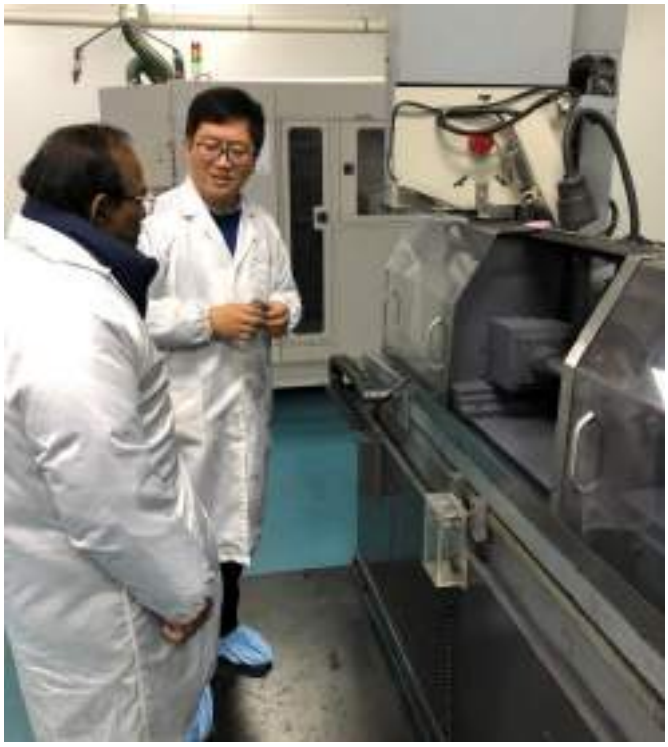
Fourier Transform Infrared (FTIR) Analysis	
IIT Madras, Chennai	Dr. K. Paranjothi, Technical Officer, Email: kpjothi@iitm.ac.in
SRM University, Chennai, Tamilnadu	http://www.srmuniv.ac.in/content/characterization-form-and-charges
Sacred Heart College, Tirupattur, Tamilnadu	Dr. M. Jose, Dean of Research,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

Dielectrics/ Impedance Analyser/ LCR meter Analysis	
VIT University, Vellore Tamilnadu	Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, 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
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; Email: nygill@gmail.com; sudheeshvd@gmail.com; vseba@yahoo.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	Dr. K. Anitha, Department of Physics, Madurai Kamaraj (MK) University, Madurai-625021, 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
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 RC, 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 RC, 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, M.P., 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 RC, SSN Institutions	Prof. P. Ramasamy, Dean (Research), SSN Research Centre, SSN Institutions, Chennai-603110, Tamilnadu, Mobile: +91-9283105760; Email: ramasamyp@ssn.edu.in

Photoluminescence (PL) Study	
Pondicherry University	Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility, Phone: 0413-2654405(Office) & 2654434, E-mail: ggraj_7@yahoo.com
IIT Madras, Chennai Tamilnadu	Dr. P. K. Sudhadevi Antharjanam, Technical Officer, IIT Chennai 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, 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
B. S. Abdur Rahman Crescent University	Dr. G.V. Vijayarhagavan, Assistant Professor, Department of Physics Mobile: +91-9790880065, Email: avvijay20@gmail.com
Nirmalagiri College, Nirmalagiri, Kerala	Dr. Nygil Thomas, Department of Physics, Mobile: +91-9496426939 Email: nygill@gmail.com; sudheeshvd@gmail.com; vseba@yahoo.com;
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, Assistant Professor, Department of Physics Mobile: +91-9790880065, Email: avvijay20@gmail.com
Baba Amravati University	Dr. Gajanan G. Muley, Professor, 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, TN, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com
VIT University, Chennai	Dr. G. Vinitha, Head, Division of Physics, School of Advanced Sciences, VIT University, Chennai-600127, Mobile: +91-9445601869; Email: vinitha.g@vit.ac.in
Baba Amravati University	Dr. Gajanan G. Muley, Professor, 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, TN, Mobile: +91-9442203480; Email: s.kalainathan@gmail.com
Baba Amravati University	Dr. Gajanan G. Muley, Professor, 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, Assistant Professor, Department of Physics, BSARU Mobile: +91-9790880065, Email: avvijay20@gmail.com
Chemical Etching/ Optical Microscope	
VIT University, Vellore Tamilnadu	Dr. S. Kalainathan, Professor & Director, Centre for Crystal Growth, VIT University, Vellore-632014, TN, 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, IIT Chennai, Email: cbaby@iitm.ac.in Phone Number: 91-44-22574944/4939/4917
Pondicherry University	Dr. G. Govindaraj, Professor of Physics and Coordinator, Central Instrumentation Facility, Phone: 0413-2654405 (O) & 2654434; E-mail: ggraj_7@yahoo.com
Cochin Univ. of Science & Technol.	Sophisticated Test & Instrumentation Centre, Cochin University of Science and Technology, Cochin-682022, Kerala, http://www.sticindia.com/saif_instruments.html

INTERNATIONAL CONFERENCE/FELLOWSHIPS/ LAB VISIT

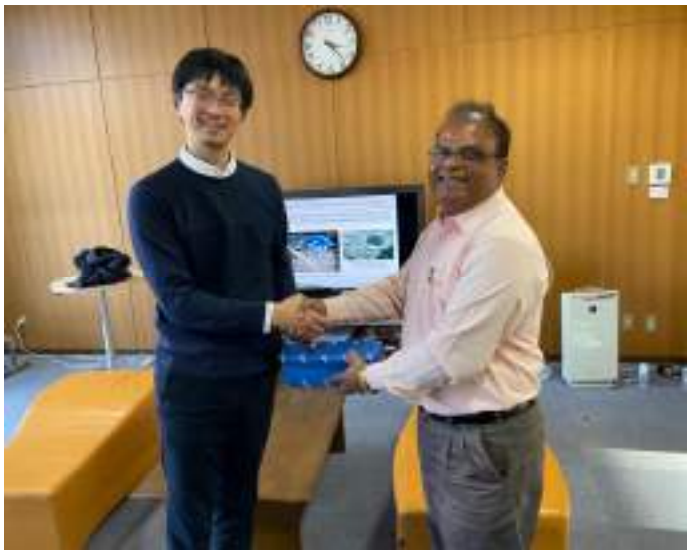
Prof. P. Ramasamy with **Dr. Tongnian Sun**, Professor, Hebei Semiconductor Research Institute, China



Prof. P. Ramasamy visited Hebei Semiconductor Research Institute, China during 21-26 November 2019

Prof. R. Jayavel receiving Leadership for Academicians Programme (LEAP) Fellowship at Cambridge University, UK on 10 June 2019

Prof. R. Jayavel with **Dr. D. Prabakaran** at Clarendon Laboratory, University of Oxford, UK on 10 June 2019



Prof. S. Kalainathan visited Tokyo Institute of Technology, Tokyo, Japan on November 2019

Prof. R. Jayavel visited Tamkang University, Taiwan on November 2019

Prof. R. Jayavel visited National Taiwan University (NTU), Taiwan on November 2019

Prof. S. Kalainathan visited Osaka Prefecture University, Japan on November 2019

Dr. M. Arivanandhan with **Prof. Ishii Kiyoshi, Prof. Shirai Yasuto, Prof. Aoki Toru** during the Inter-Academia Asia Meeting held at Shizuoka University, Japan on 2 December 2019

Prof. K. K. Bamzai with **Dr. Vladimir Sergeevich Pavelyey**, Samara University, Russia in ICSET-2019 at Tashkent Uzbekistan during 30 May - 1 June 2019

Prof. G. Ravi delivering lecture in World Congress on Lasers & Photonics at Barcelona, Spain during 23-25 September 2019

Prof. S. Kalainathan in The 10th Asia Material Scientist Expert Meeting at Hokkaido, Japan during 29-31 August 2019

Prof. S. Kalainathan delivering lecture in 2nd World Summit on Advances in Science at Indiana University, USA during 3-5 October 2019

Prof. Binay Kumar with **Prof. Zappettini** in the ICCGE-19/OMVPE-19 Keystone, CO, USA, during 28 July 28-2 August 2019

Dr. D. Joseph Daniel with **Dr. Suja Elizabeth** & **Dr. D. Prabakaran** in the ICCGE-19/OMVPE-19 Keystone, USA during 28 July 28-2 August 2019

Dr. D. Joseph Daniel with **Dr. D. Prabakaran**, **Dr. Binay Kumar** and **Dr. R. R. Sumathi** in the ICCGE-19 during 28 July 28-2 August 2019

CRYSTAL GROWTH (CG) RELATED JOURNALS WITH THOMSON REUTERS IMPACT FACTOR – FEBRUARY 2020

Journal Name	IF
Applied Surface Science	5.1
Applied Physics A : Materials Science and Processing	1.7
Arabian Journal of Chemistry	3.2
Bulletin of Materials Science	0.8
Chinese Science Bulletin	6.2
Chemical Physics Letters	1.9
Crystal Growth and Design	4.1
Crystal Engineering Communication	3.3
Crystal Research and Technology	1.0
Current Applied Physics	2.0
Ferroelectrics	0.6
Japanese Journal of Applied Physics	1.4
Journal of Crystal Growth	1.5
Journal of Applied Crystallography	2.8
Journal of Alloys and Compounds	4.1
Journal of Physics and Chemistry of Solids	2.0
Journal of Solid State Chemistry	2.1
Journal of Physics: Condensed Matter	2.7
Journal of Materials Chemistry	6.6
Journal of Materials Science and Technology	5.0
Journal of Materials Science: Materials in Electronics	2.1
Journal of Physics: Condensed Matter	2.7
ACS Photonics	6.8
Chemistry of Materials	10.1
Frontiers of Materials Science	1.7
Journal of Nonlinear Optical Physics & Materials	1.4

Journal Name	IF
Journal of Thermal Analysis and Calorimetry	2.4
Materials Letters	3.0
Materials Chemistry and Physics	2.2
Materials Research and Bulletin	3.3
Materials Characterizations	3.2
New Journal of Chemistry	3.0
Optical Materials	2.0
Optics Communications	1.8
Optics and Laser Technology	3.3
Optik- International Journal for Light and Electron Optics	1.9
Progress in Crystal Growth and Characterization of Materials	3.8
Physica B:Condensed Matter	1.8
RSC Advances	3.0
Results in Physics	3.0
Science of Advanced Materials	3.5
Solid State Communications	1.4
Solid State Science	2.1
Spectrochimica Acta Part A: Molecular and Biomolecular Spectro.	2.9
Surface Science Letters	2.0
Synthetic Metals	2.5
The European Physical Journal of Applied Physics	0.76
Acta Crystallographica A-Foundation and Advances	2.3
Crystallography Reviews	3.0
Advanced Optical Materials	7.4
Electronic Materials Letters	1.8
Journal of Electronic Materials	1.6
Materials Research Express	1.4

YOUNG / SENIOR RESEARCHERS FORUM

Prof. V. Devanathan received ISTA-Elavenil - Life Time Achievement Award-2019 for his outstanding contribution in Physical Sciences in the MCGPD-2019 held at SSN College of Engineering, Chennai during 26-28 February 2019

MRSI MEDAL - 2019

Prof. R. Jayavel, Professor, Crystal Growth Centre, Anna University, Chennai, Tamilnadu received MRSI Medal – 2019 for his significant contribution in Materials Science. Prof. R. Jayavel with **Prof. C. N. R. Rao** and **Prof. H. L. Bhat** during MRSI award ceremony. This programme was held at IISc, Bangalore on 12 February 2019.

MHRD - LEAP AWARD - 2019

Prof. S. Moorthy Babu, Professor, Crystal Growth Centre, Anna University, Chennai selected for Leadership for Academicians Programme (LEAP) 2019-2020, a flagship initiative under the aegis of the Ministry of Human Resource Development, Government of India. This programme was held at IIT (BHU), Varanasi during 8-21 December 2019.

YOUNG SCIENTIST AWARD - 2019, THE ACADEMY OF SCIENCES, CHENNAI

Dr. M. Arivanandhan, Anna University received Young Scientist Award-2019 from the Academy of Sciences, Chennai on 8 March 2019

Dr. R. Siva Kumar, Alagappa University received Young Scientist Award-2019 from the Academy of Sciences, Chennai on 8 March 2019

ISPA- Dr. S.GUNASEKARAN AWARD-2019

Dr. Muthu Senthil Pandian received ISPA - Dr. S. Gunasekaran Award-2019 in NCETMS-2019 held at Govt. Arts College, Tiruvannamalai during 26-27 September 2019

VIDYA EDUCATIONIST AWARD -2019

Dr. M. Selvapandiyan, Periyar University PG Extension Centre, Dharmapuri received Vidya Educationist Award held at Sri Vidya Mandir Arts and Science College on 18 October 2019

PATENT FILED-2019

Inventors: P. Sampathkumar, K. Srinivasan*, K. Kadirvelu
Department of Physics, Bharathiar University, Coimbatore, Tamil Nadu

1. Process for Preparation of Single Crystals and its Applications thereof.
Indian Patent Application Number: **201911008920**
Filed on: March 07, 2019 through DRDO-BU CLS

2. Pyroelectric Infrared Detector and Method thereof.
Indian Patent Application Number: **201911008519**
Filed on: March 05, 2019 through DRDO-BU CLS

3. Magnetic Stirring Apparatus
Indian Patent Application Number: **201911008463**
Filed on: March 05, 2019 through DRDO-BU CLS

LIFE TIME ACHIEVEMENT AWARDS - 2019

Prof. P. Ramasamy received Life Time Achievement Award-2019 in ICRAMS-2019 held at National College, Tiruchirappalli during 4-6 February 2019

Prof. S. Gunasekaran received Life Time Achievement Award-2019 in ICRAMS-2019 held at National College, Tiruchirappalli during 4-6 February 2019

LIFE TIME ACHIEVEMENT AWARD-2019

Prof. R. Jayavel received Life Time Achievement Award in NCETMS-2019 held at Govt. Arts College, Tiruvannamalai during 26-27 September 2019

MHRD - LEAP AWARD -2019

Prof. K. Sankaranarayanan, Dean (Science), Alagappa University selected for LEAP-2019 held at IIT (BHU), Varanasi during 8-21 December 2019

BEST ACHIEVER AWARD-2019

Dr. S. Stephen Rajkumar Inbanathan, The American College received Best Achiever Award-2019 in ICRAMS held at National College, Trichy during 4-6 February 2019

DOCTOR OF SCIENCE AWARD - 2019

Prof. G. Ravi received Doctor of Science (D.Sc.) award from Banwarilal Purohit, Governor of Tamil Nadu at Alagappa University, Karaikudi during the 31st Convocation

USIEF - FULBRIGHT FELLOWSHIP - 2019

Dr. K. J. Arun, Sree Kerala Varma College, Kerala awarded as "**USIEF-Fulbright Scholar"** from February 2019 to carry out his research at College of Engineering & Technol., Department of Physical Sciences, Alabama University, USA.

HONORABLE GUEST PROFESSOR AWARD - 2019

Prof. G. Ravi, Professor and Head, Department of Physics, Alagappa University, Karaikudi, Tamil Nadu received "**Honorable Guest Professor Award - (HGPA-2019)"** for his outstanding performance in Shizuoka University, Japan on 1st April 2019.

ISTA-ELAVENIL - BEST RESEARCH CONTRIBUTION AWARD - 2019

Dr. C. Senthil Kumar, Assistant Professor, Department Physics, Government Arts College, Hosur received "**ISTA - Elavenil Best Research Contribution Award-2019"** in the MCGPD-2019 held at SSN Institutions during 26-28 February 2019.

UGC- KOTHARI POST DOCTORAL FELLOWSHIP (KPDF)- 2019

Dr. Kanika Thukral, former Ph.D. student of Dr. N. Vijayan, Principal Scientist, CSIR-NPL, New Delhi got a prestigious "**UGC - Kothari Post Doctoral Fellowship (KPDF)"** for higher research at DTU, New Delhi on October 2019.

TNSCST YOUNG SCIENTIST AWARD (YSA - 2019)

Dr. G. Ramalingam, Alagappa University, Karaikudi received **TNSCST - "Young Scientist Award (YSA)"** on 25th May 2019. He has visited Jawaharlal Nehru Technological University, Hyderabad for one month and worked in worked in semiconductor material.

ROYAL SOCIETY OF CHEMISTRY (RSC) - TOP CITED AUTHOR - 2019

Dr. P. Karuppasamy, SSN Research Centre, SSN College of Engg., Chennai received **"RSC - Top Cited Author Certificate"** from RSC on 20th October 2019. He has been listed in the top 10% of highly cited authors in the General Chemistry portfolio of journals.

ELECTED AS FELLOW OF ASCh AND MEMBER OF NASI - 2019

Dr. N. Vijayan, Principal Scientist, CSIR-National Physical Laboratory, New Delhi is elected as a "**Fellow"** of the Academy of Sciences (FASCh), Chennai and elected as a "**Member"** of the National Academy of Sciences (MNASc), India (NASI), Allahabad in 2019.

BHARATH EXCELLENCE AWARD – (BEA-2019)

Dr. G. Vinitha, Head, Division of Physics, School of Advanced Sciences (SAS), Vellore Institute of Technology Chennai, T.N. received "**Bharat Excellence Award-2019"** for the outstanding research contribution at New Delhi on 24 February 2019.

INSA VISITING SCIENTIST AWARD – (VSA-2019)

Dr. K. Sakthipandi, Associate Professor, Department of Physics, Sethu Institute of Technology, Madurai received **"INSA Visiting Scientist Award"** on 6th March 2019. He visited Indian Institute of Science (IISc), Bangalore for two months.

PARTICIPATION IN LINDAU NOBEL LAUREATE MEETING - 2019

Mr. Sahil Goel, Ph.D. Scholar, C/o Prof. Binay Kumar, Department of Physics, University of Delhi selected and participated in the "**69th Lindau Nobel Laureate Meeting**" in Lindau, Germany during 30 June - 5 July 2019. funded by DST.

CERTIFICATE OF ACHIEVEMENT FOR BEST RESEARCH LAB - 2019

Dr. S. Jerome Das, Department of Physics, Loyola College, Chennai, Tamil Nadu received an Appreciation Certificate for achieving the **"Best Research Laboratory Unit (RLU)"** of Crystals Research Lab for its pioneering efforts at Loyola Research Day on 28th February 2019.

CERTIFICATE OF ACHIEVEMENT FOR OUTSTANDING RECOGNITION

Dr. J. Madavan, Dean & Associate Professor, Department of Physics, Loyola College, Chennai received "**Appreciation Certificate"** for receiving project grants and Outstanding recognition from agencies in Loyola College at Loyola Research Day-2019 on 28th February 2019.

APPOINTED AS PRINCIPAL IN CKN COLLEGE - 2019

Dr. P. Murugakoothan, Life Member of IACG, Executive member of ISTA and Associate Professor, Department of Physics, Pachaiyappa's College, Chennai, Tamil Nadu is appointed as "**Principal**" in C. Kandaswami Naidu College for Men, Chennai 8th May 2019.

APPOINTED AS SYNDICATE MEMBER IN ALAGAPPA UNIVERSITY

Dr.K.Sankaranarayanan, Dean (Science), Director, USIC & Professor, Crystal Growth Laboratory, Department of Physics, Alagappa University, Karaikudi, Tamil Nadu is appointed as **"Syndicate Member"** in Alagappa University, Karaikudi from 10th January 2020.

APPOINTED AS HEAD IN CRYSTAL TECHNOLOGY SECTION, TPD, BARC

Dr. Shashwati Sen, Scientific Officer-G, BARC is appointed as **"Section Head of the Crystal Technology Section (CTS)"**, Technical Physics Division (TPD), Bhabha Atomic Research Centre (BARC), Mumbai, Maharastra on 24th October 2019.

DAE - RAJA RAMANNA FELLOW (DAE-RRF-2019)

Dr. S. C. Gadkari, Formerly Outstanding Scientist is awarded as "**DAE - Raja Ramanna Fellowship**" to work in the Crystal Technology Section (CTS), Technical Physics Division (TPD), Bhabha Atomic Research Centre (BARC), Mumbai on July 2019.

APPOINTED AS VICE-PRESIDENT IN CRYSTALLOGRAPHY ASSOCIATION

Prof. Rajni Kant, Professor, University of Jammu, Jammu has been elected as the "**Vice President (VP)**" of the Indian Crystallographic Association (ICA) for which the election took place during the General Body Meeting of the ICA at BARC, Mumbai on 20th June 2019.

CSIR – EMERITUS SCIENTIST SCHEME - 2019

Prof. C. K. Mahadevan is selected as a "**CSIR Emeritus Scientist**" from 1st July 2019. CSIR, has sanctioned the Grant-in-aid for his Emeritus Scientist Scheme to work (Crystal Growth) in the Department of Physics, Bharathidasan University, Trichy, Tamil Nadu as a CSIR Emeritus Scientist.

NOVEL WORK DONE IN CRYSTAL GROWTH

Growth of Nd:$GdVO_4$ crystal and demonstration of lasing

Soharab, Indranil Bhaumik, R. Bhatt, A. Saxena, A.K. Karnal*
Crystal Growth and Instrumentation Section, Laser & Functional Materials Division,
Raja Ramanna Centre for Advanced Technology, Indore-452013, Madhya Pradesh, India

Neodymium-doped gadolinium orthovanadate (Nd:$GdVO_4$) has attracted a lot of attention as a gain medium for diode pumped solid-state lasers with emission at ~1064 nm. For the growth of the crystals, feed-rods were prepared from the synthesized chemical using cold hydrostatic press at 70 MPa. The feed rod was sintered at 1380 ° C for 10 hours in air. Crystal growth was carried out in a four halogen lamp based optical floating zone system (FZ-T-10000-H-HR-I-VPM-PC). Crystal growth experiments were carried out using [100]-oriented seeds, with rotation of upper and lower shaft as 30 rpm in mutually opposite direction and growth rate of ~12-15 mm/h. Crystals of diameter ~5-6 mm and length ~10-30 mm were grown (Figure. 1). The crystal was mounted in a 3-axis goniometer and Laue pattern was recorded. Laue pattern of the (100) plane is shown in Figure. 2. From the oriented crystal laser element of dimension 4x4x6 mm^3 was prepared as shown in Figure. 3.

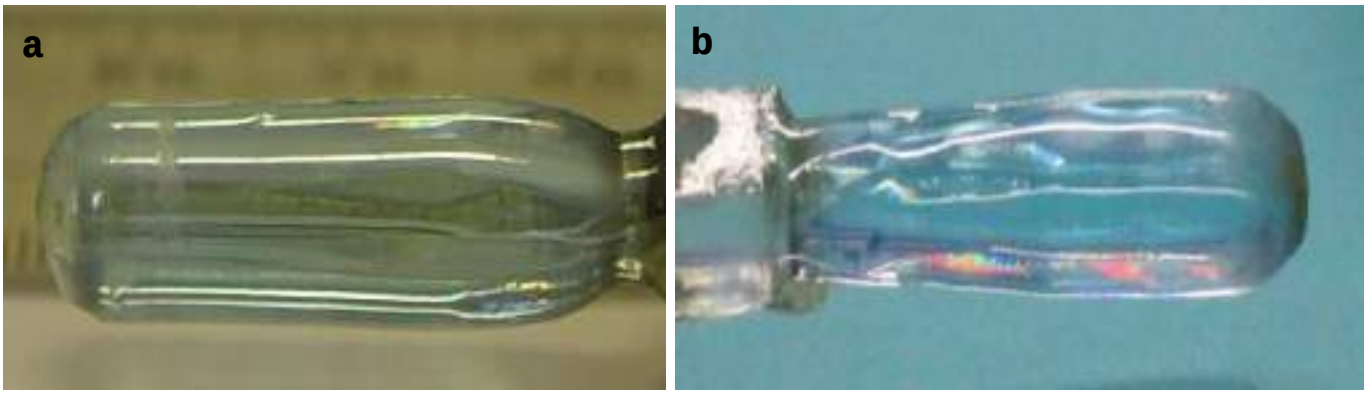


Figure.1 *As-grown crystals of Nd:$GdVO_4$*

The testing of lasing for a-oriented element carried out using plane-plane mirror geometry (output coupler reflectivity =89%) with 808 nm pumping at LTD, RRCAT. The length of the cavity was 50 mm. CW laser emission at 1064 nm was demonstrated. The laser output power of 9.1 W at 1064 nm was achieved for 24.4W of incident pump power. The slope efficiency was around 42%. The profile of the laser output is nearly Gaussian (Figure. 3).

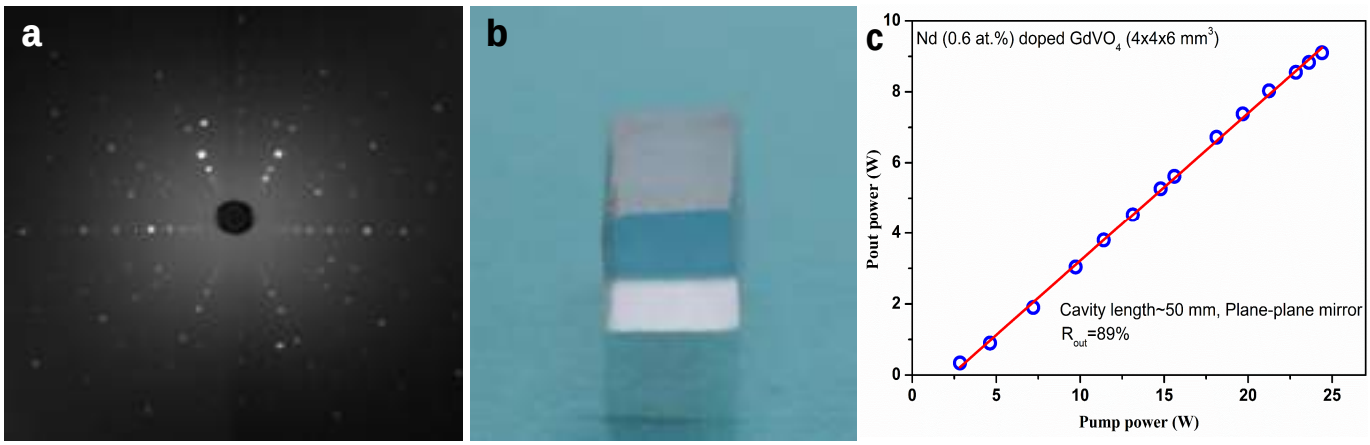


Figure.2 (a) *Recorded [100] Laue pattern,* ***(b)*** *Fabricated [100] laser element,* ***(c)*** *Lasing Performance*

Development of Travelling Heater Technique for growth of $Cd_{0.9}Zn_{0.1}Te$ single crystals for Gamma Detector applications

P. Vijayakumar[1], E. P. Amaladass[1], K. Ganesan[1], R. M. Sarguna[1], S. Chinnathambi[1], S. Ganesamoorthy[1,2], V. Sridharan[1,2], Awadhesh Mani[1,2], N. Subramanian[1,2]

[1]Materials Science Group (MSG), IGCAR, Kalpakkam-603102, Tamil Nadu, India

[2] Homi Bhabha National Institute (HBNI), IGCAR, Kalpakkam-603102, Tamil Nadu, India

$Cd_{0.9}Zn_{0.1}Te$ (CZT) is a well-known compound semiconductor material used for high energy gamma radiation detector applications. CZT detectors exhibit a energy resolution of less than 2% (for the 662 keV gamma line of ^{137}Cs) which compares very favorably with a resolution between 7-10% (NaI(Tl) and CsI(Tl) detectors) and is also much better than the 3% resolution exhibited by the Ce-$LaBr_3$ detectors. Ease of operation – no cooling requirements - renders CZT superior for gamma detection.

$Cd_{0.9}Zn_{0.1}Te$ (CZT) could be grown by high pressure Bridgman process or by travelling heater technique. Lower growth temperature in THM process helps to achieve high crystalline perfection. However, growth rate of CZT by THM is of the order of 1-3 mm/day which is a time consuming process. We have designed and developed THM equipment for growing CZT crystals. The requisite multi zone resistive heated furnace has been fabricated by adopting a novel design through which we could achieve temperature gradient of 10-50 ºC/cm. Special vacuum sealing setup for quartz tube, carbon coating of quartz tube, crystal puller, design of heater for controlled annealing of the grown crystal have also been developed. Several CZT/Te ratio were attempted and the ideal Te concentration, growth rate, temperature gradient, rotation rate were optimized to yield large single grain samples upto 10 mm x 10 mm cross-section from a quartz ampoule of 20 mm diameter. The grown CZT crystals were subjected to XRD rocking curve analysis, Laue diffraction, I-V measurements and optical studies.

Figure.1 (a) *Indigenously developed THM crystal growth system,* ***(b)*** *Temperature profile of two zone furnace,* ***(c)*** *Stages of CZT crystal growth* ***(d)*** *Optimization of CZT/Te ratio* ***(e)*** *CZT wafers and* ***(f)*** *As Grown CZT crystals (each growth run 60 days)*

Growth of large size CsI:Tl single crystal by Bridgman technique

S.G. Singh, D.G. Desai, G. D. Patra, Shastwati Sen, S.C. Gadkari
Crystal Technology Section (CTS), Technical Physics Division (TPD),
Bhabha Atomic Research Centre (BARC), Mumbai-400085, Maharastra, India

Large size single crystals (~ 3 kg) of CsI:Tl in large numbers (40-50 kg total weight) are required for the development of detector for the Dark Matter Search experiment being setup at Jaduguda underground Lab facility in collaboration with SINP. Crystal Technology Section (CTS), Technical Physics Division (TPD), BARC has grown the CsI:Tl single crystal of diameter 75 mm and length 100 mm using Bridgman crystal growth technique in a carbon coated quartz crucible. For this large diameter two zone Bridgman furnace was designed and fabricated locally. Quartz crucible of diameter 77mm was coated with carbon and the growth was carried out. A single growth took around 15 days. Process was optimized to get transparent and bubble free crystal without carbon inclusions. The energy resolution measured for a typical crystal of diameter 65 mm and length 65 mm is 6.9% at 662 keV.

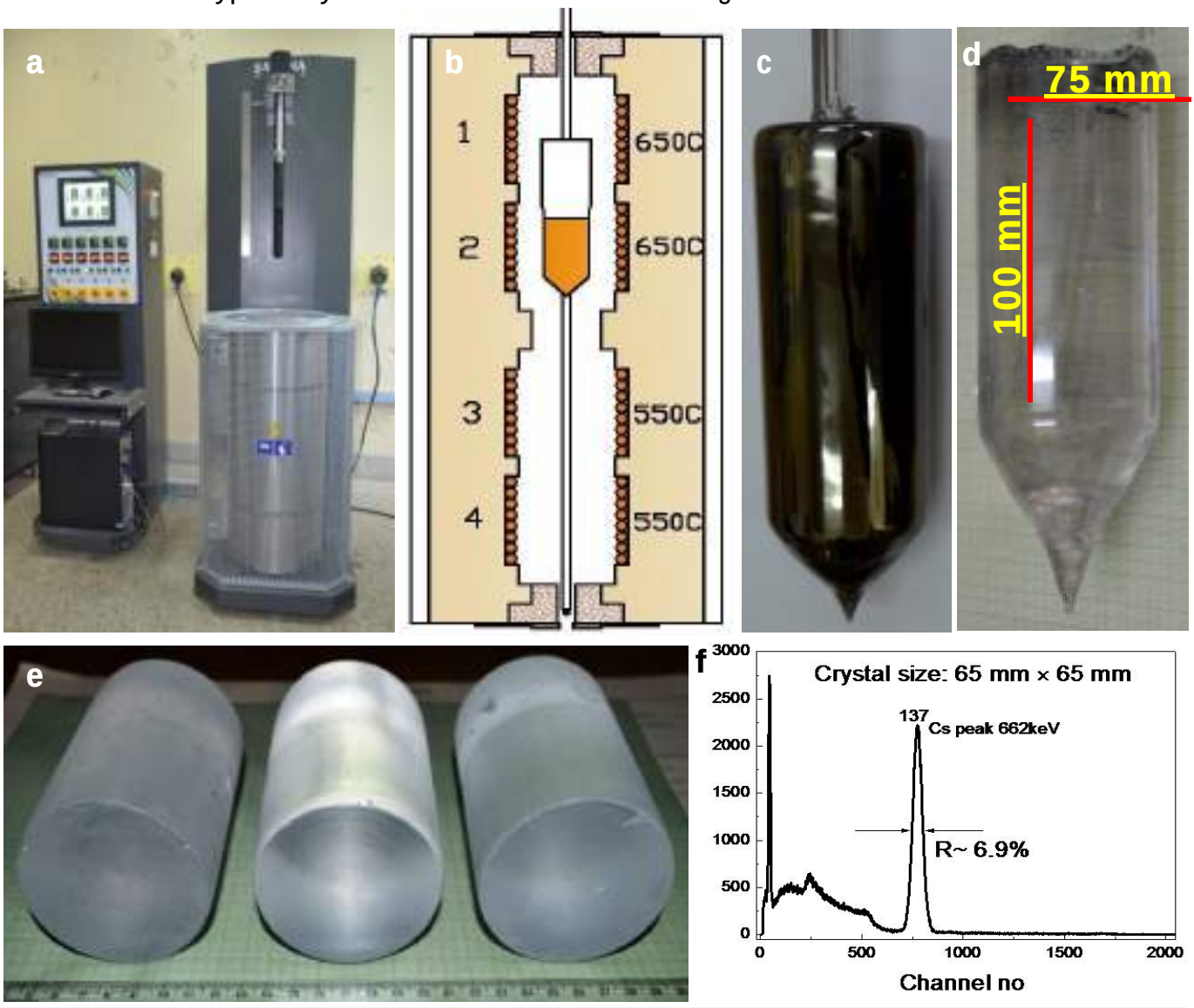


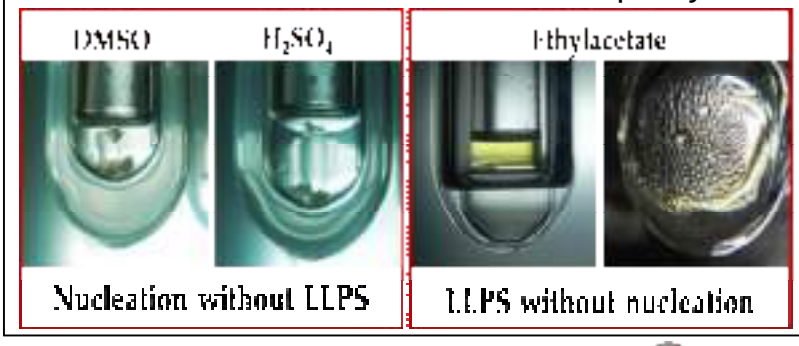
Figure.1 (a) *Actual photograph,* ***(b)*** *Schematic of Bridgman Furnace system developed for the growth of large size single crystals,* ***(c)*** *carbon coated quartz crucible,* ***(d)*** *CsI:Tl single crystal of size 75 mm diameter and 100 mm,* ***(e)*** *Cut and polished CsI:Tl single crystals,* ***(f)****Gamma spectra for ^{137}Cs source recorded using the large size cut and polished CsI:Tl single crystal*

Effective control of liquid–liquid phase separation and nucleation of Vanillin single crystals through a Vapor Diffusion Crystallization process in selected solvent environments

S. Supriya, S. Sushmitha, K. Srinivasan*
Crystal Growth Laboratory, Department of Physics, School of Physical Sciences,
Bharathiar University, Coimbatore-641046, Tamil Nadu, India

Vanillin ($C_8H_8O_3$) is one of the popular flavoring resources used widely in food and in pharmaceutical preparations. Crystallization of vanillin is the final step in the manufacturing process which had faced a great struggle due to the tendency of the compound to form liquid-liquid phase separation (LLPS) in its solution state which affects the nucleation process greatly from the aqueous solution. While trying to crystallize the vanillin from saturated aqueous solution, before the onset of nucleation, the solution becomes cloudy due to the formation of the secondary liquid phase, also known as oiling out, which affects the nucleation, crystal size, morphology, form etc., In this contribution, in order to eliminate the LLPS during crystallization, the influence of different solvent environments on the occurrence of LLPS and the crystallization of vanillin from aqueous solution was studied through the vapor diffusion process and reported for first time with the best of our knowledge. Experimental results clearly reveal that the prevailing vapor pressure as a consequence of diffusion control at the solvent environment and the experimental temperature influence greatly the creation of the required level of supersaturation for the induction of crystal nucleation within the solution, and the consequence of this process leads to the complete control over the occurrence of LLPS in the solution.

In the absence of any solvent environment, the saturated solution always gets nucleated only after a long period of induction time because of the precedency of the occurrence of LLPS well prior to the crystal nucleation within the solution. Because of the extraordinary hygroscopic nature and moisture absorbing behavior of both the DMSO and H_2SO_4 solvent environments selected in the present study, they generate concentration gradients within the solution column through the vapor diffusion process and consecutively create the sufficient level of supersaturation required for the crystal nucleation that occurs prior to the occurrence of LLPS, whereas ethyl acetate, another solvent environment created in the present study, being non-hygroscopic in nature and also having a higher vapor pressure than that of the water, creates an environment in which there was no possibility for the evaporation of water molecules from the solution and favors very much the precedency of occurrence of LLPS prior to the crystal nucleation and suppresses completely the crystal nucleation of vanillin within the solution. Nucleated and further grown vanillin single crystals have plate-like morphology, and the PXRD study indicates that they belong to monoclinic Form-I polymorph of vanillin having space group P21. DSC and FTIR analyses carried out on the nucleated crystals reveal that the diffusion process has no effect on the thermal stability of the grown single crystals of vanillin and maintains the same chemical purity.



Overall, the vapor diffusion crystallization process with suitable solvent environments is an effective method for controlling the occurrence of unwanted LLPS prior to the crystal nucleation and to promote the crystallization of stable polymorphs of vanillin from aqueous solution.

A method for preparation of well faceted seed crystal directly in seed holder and its use for growth of large size flat-top KDP crystal

S. K. Sharma*, Yashpal Singh, Indranil Bhaumik, A. K. Karnal
Crystal Growth Laboratory, Crystal Growth and Instrumentation Section,
Laser and Functional Materials Division, RRCAT, Indore-452013, Madhya Pradesh, India

A technique has been developed for preparation of c-elongated and well faceted KDP seed crystal directly in a seed holder from small size crystal piece. In this technique teflon make seed holders were fabricated and used for regeneration of small size KDP crystal piece placed inside it. Fig 1(a) shows schematic of the seed holder and Fig 1(b) shows the fabricated teflon make seed holders mounted at a small size acrylic platform. Small size crystal piece was mounted inside each of the seed holder and their regeneration and growth was carried out in a small amount of KDP solution in the crystallizer. Fig. 1(c) shows well faceted seed crystals emerge out of the seed holders. One of the seed holder containing the prepared seed was used for further growth in a large size crystallizer. Fig. 1(d) shows as-grown Flat-top[1] shape KDP crystal without any spurious nucleation. The grown crystal was characterized for optical quality and defects confirming its suitability for device applications.[2]

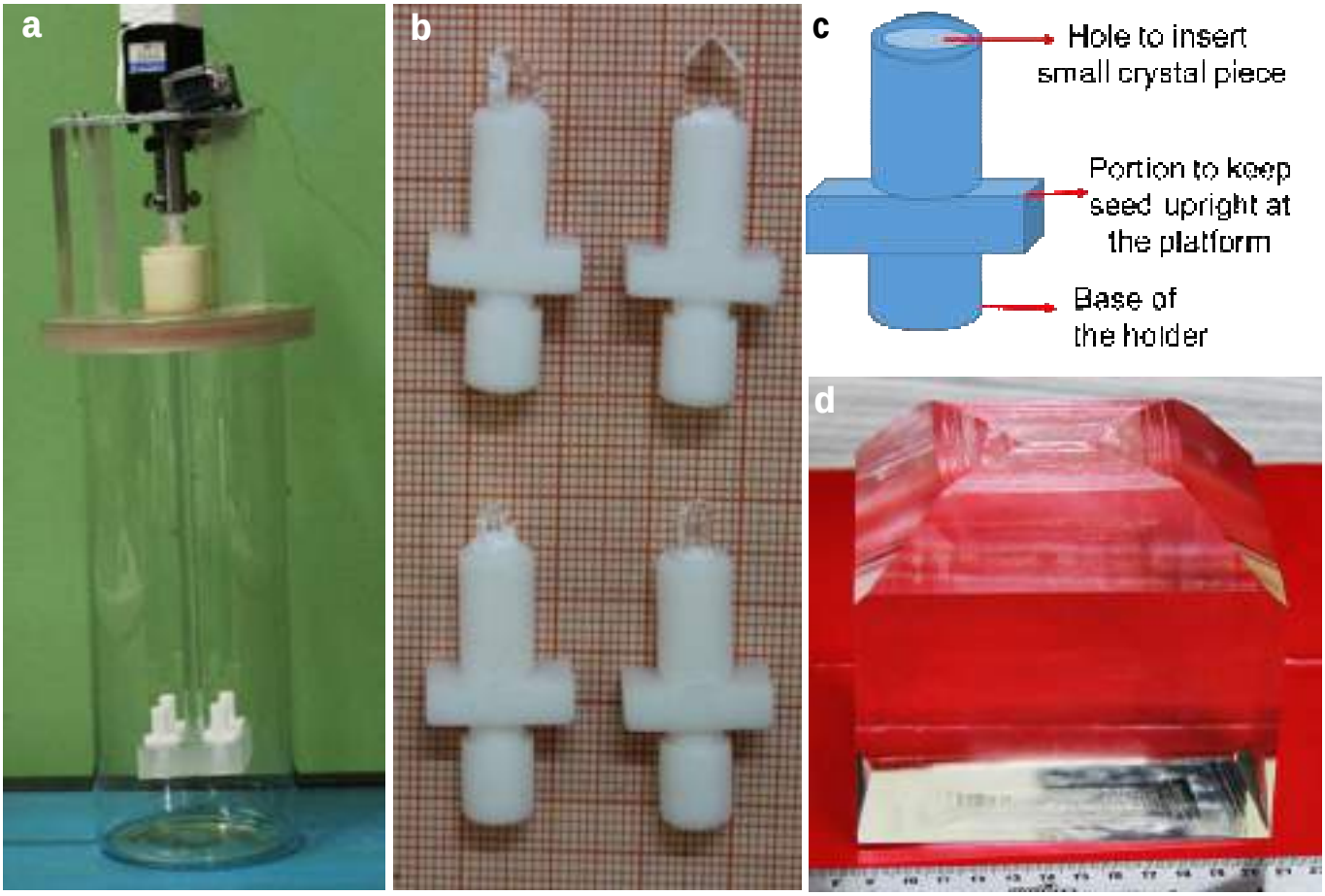


Figure.1 (a) *Schematic of seed holder,* ***(b)*** *seed holders containing crystal piece and mounted at a small size platform in the crystallizer,* ***(c)*** *well faceted seeds emerge out of the seed holders after their regeneration and growth, and* ***(d)*** *as-grown Flat-top KDP crystal of size 120×90×113 mm^3 and mass ~ 2.7 kg using one of the seed holder shown at Figure 1(c)*

References

1. S. K. Sharma, Sunil Verma, Yashpal Singh, K.S. Bartwal, *Cryst Eng Comm,* 15, 9995 (2013).
2. S. K. Sharma, et. al, DAE-BRNS National Laser Symposium-28, 8-11 January 2020, VIT Chennai.

Development of single crystalline β-Ga_2O_3 growth technology

S. Moorthy Babu
Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu, India

A new oxide semiconductor gallium oxide (Ga_2O_3) turns out to be an ideal material for power devices in ultra-high voltage switching applications. The superior material properties of Ga_2O_3, including a bandgap much larger than those of SiC and GaN, promise power devices with even higher Vbr and efficiency than their SiC and GaN counterparts. The superiority of Ga_2O_3 devices for mass production stems from the availability of affordable native substrates fabricated from melt-grown bulk crystals at low cost and with low energy consumption. Gallium oxide (Ga_2O_3) is one of the promising material for oxide high power electronics, Scintillators, medical imaging, gas sensors, UV detectors, Lasers, and variety of applications. It has different forms of polymorphs such as α-, β-, γ-, δ- , ε- . Among these phases, the β-form is the most common and well-studied polymorph of Ga_2O_3. Edge defined film fed growth, Czochralski crystal growth, Bridgman growth, Mist-CVD, Flux, Pulsed laser deposition and Floating Zone are the methods used to grow single crystals. Good quality single crystals of β-Ga_2O_3 were successfully grown using FZ technique.

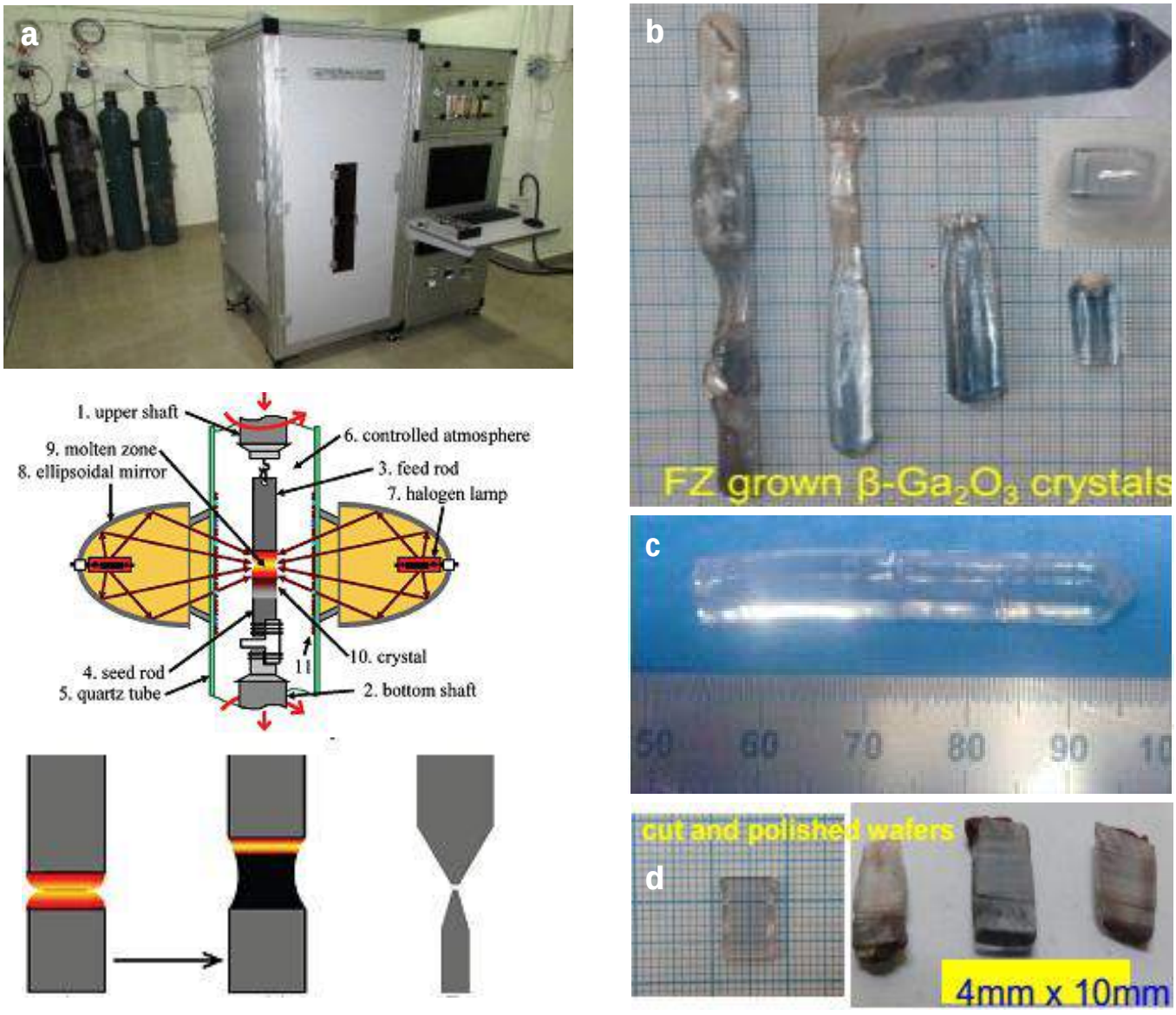


Figure.1 (a) *FZ Experimental setup,* ***(b, c)*** *FZ grown* Ga_2O_3 *crystals and* ***(d)*** *Cut and polished wafers*

FABRICATION OF SINGLE CRYSTAL DEVICES

Bridgman growth of Trans-Stilbene (TSB) single crystals for Neutron Detector applications

S. Kar[1], Sunil Verma[1,2],*, C. Debnath[1,2], V. S. Tiwari[1,2], A. K. Karnal[1,2]

[1] Laser & Functional Materials Division, Raja Ramanna Centre for Advanced Technology (RRCAT), Indore-452013, India

[2]Homi Bhabha National Institute, BARC Training School Complex, Mumbai-400095, India

Trans-stilbene ($C_6H_5CH=CHC_6H_5$; TSB) is a stable, solid, non-hygroscopic, non-flammable & non-hazardous material. This crystal has high scintillation efficiency on excitation with fast neutrons (>1 MeV). This crystal has been used for fast neutron detector, imaging & spectroscopy. It has applications in homeland security and defence. This has direct detection of fast neutron detection. No need of moderation of the neutron to thermal energies. Due to superior pulse shape discrimination (PSD) properties w.r.t. liquid and plastic scintillators, it represents state-of-the-art material for fast neutron detectors. The scintillation signal consists of a prompt and a delayed fluorescence. Prompt signal → due to gamma; Delayed signal → Due to neutrons. Trans-stilbene ($C_6H_5CH=CHC_6H_5$; TSB) is a congruently melting compound, but has high vapour pressure, therefore Czochralski method is not suitable for its growth. To avoid this problem Bridgman technique has been used in the present work.

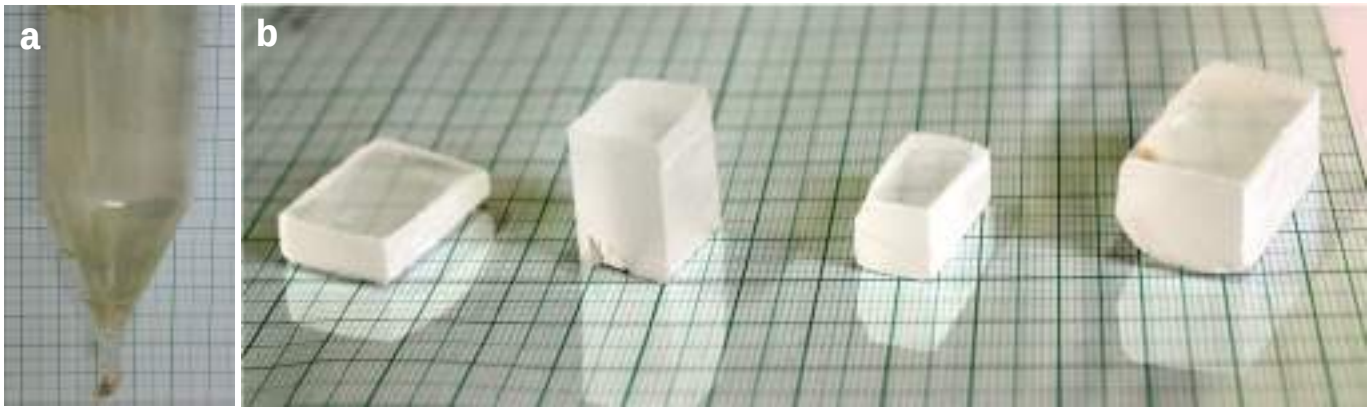


Figure.1 (a) *Trans-stilbene (TSB) crystal grown by Bridgman method,*
(b) *Fabricated Trans-stilbene crystal elements*

Optimized Growth Parameters

- Growth Temperature: 125 ºC
- Chemical purity: 98% pure chemical purified further by zone melting
- Heat zones in furnace & temp gradient : Two, 8 ºC/cm
- Translation rate: 0.5 mm/hr in the beginning & 0.25 mm/hr later
- Shape of ampoule: Bend at the conical tip of ampoule
- Crystals of size ϕ=30mm & L=50mm have been grown

Trans-stilbene (TSB) chemical of 98% purity was used. Purification of chemical was done by zone melting technique. Purified chemical was used for growth of crystals. Single crystal of TSB are grown by Bridgman crystal growth technique by optimizing different growth parameters. Crystals of size ϕ=30 mm and L=50 mm have been grown. Elements of different sizes have been fabricated for testing at bhabha atomic research centre (BARC) for neutron detection and Indus-2 for X-ray imaging applications.

Growth of LiI:Eu single crystals for Thermal Neutron Detector and development of portable and efficient Neutron Detectors

Mohit Tyagi, A.K. Singh, Shastwati Sen, S.C. Gadkari
Crystal Technology Section (CTS), Technical Physics Division (TPD),
Bhabha Atomic Research Centre (BARC), Mumbai-400085, Maharastra, India

Lithium isotope, ^{6}Li has higher capture cross section (~ 940 barns) for thermal neutrons interaction via following nuclear reaction $^{1}n + {}^{6}Li \rightarrow {}^{3}H + {}^{4}He + 4.8$ MeV. The generated charged particles with a high "Q" value generate scintillation which can be detected by photo-sensors like PMT etc. The scarcity of ^{3}He and toxic nature of BF_3, there is strong demand for the alternate of these conventional thermal neutron detectors. Additionally, the higher atomic densities in single crystals lead to a much higher detection efficiency for the development of compact detectors. Single crystals of 0.1 % Europium doped Lithium Iodide (LiI:Eu) produce efficient luminescence at ~ 470 nm and therefore have been proven to be a potential thermal neutron scintillator. However, the LiI is highly hygroscopic in nature and therefore lead to various challenges in the growth of single crystals including the dehydration procedure of raw material. After the crystal growth, the processing for a scintillator disk and the hermetic sealing of the processed scintillator also affects the detector properties and their long term performance. In crystal technology section, the transparent single crystal of about 2 inch diameter and 80 mm length have been successfully grown. Scintillators processed form these single crystals were characterized and the long term detector performance has been also investigated to standardize the hermetic sealing procedure. Eventually, portable detector have been developed which can be easily carried out at remote locations without heavy NIM modules, HV supplies etc. The performance characteristics of these detectors have been measured with various standard neutron sources. Moreover, in case of low flux measurements, multiple detectors can be operated and controlled from a single window. These detectors can be also operated on LAN networks for the remote operations.

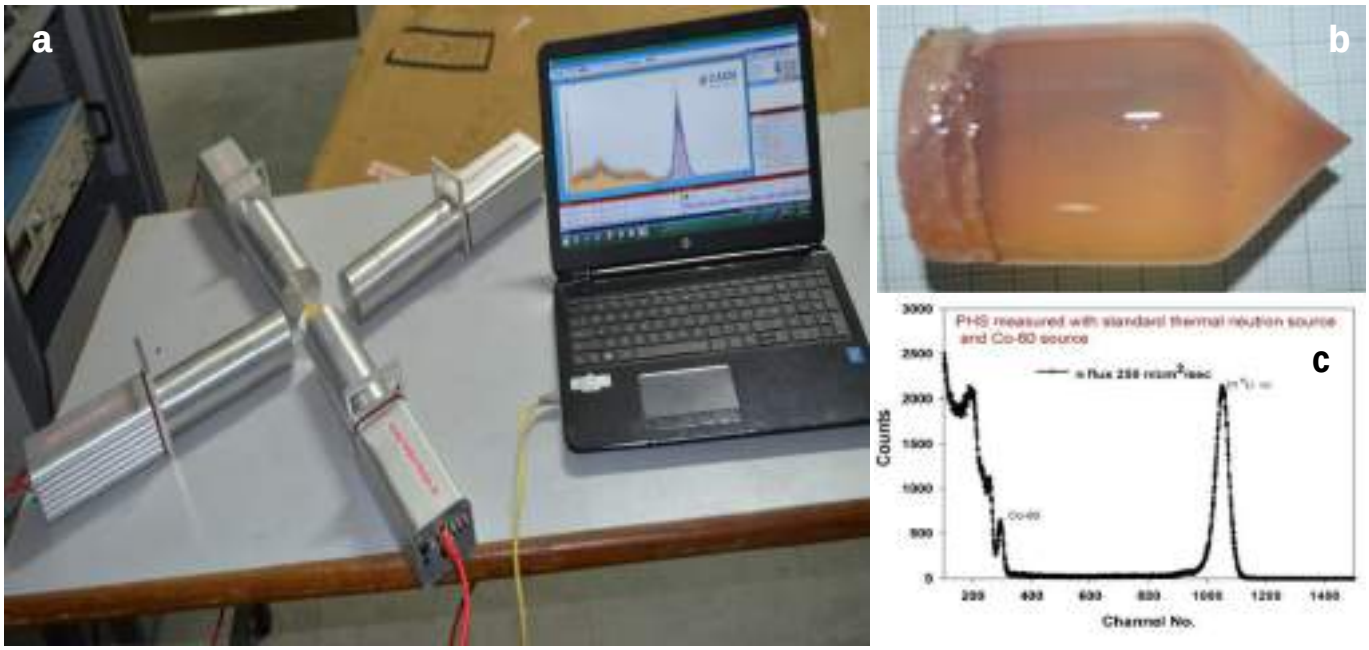


Figure.1 (a) *In-house developed multiple portable detectors which can be used for any single crystal scintillators for thermal or gamma detection as per the application requirement*
(b) *Single crystal of 2" × 2" LiI:Eu for thermal neutron detection and*
(c) *Measured thermal spectrum using in-house developed detector based on these crystals*

Need of reference material for calibrating different parameters of Powder X-ray diffractometer

Manju Kumari[1, 2], Debabrata Nayak[1, 2], Sudha Yadav[1,2], R.P.Pant[2], N.Vijayan[2,*]

[1] Academy of Scientific & Innovative Research (AcSIR), Ghaziabad-201002, Uttar Pradesh, India

[2] BND Division, CSIR - National Physical Laboratory (NPL), New Delhi-110012, India

Accuracy and precision are two main key factors for taking data and to perform scientific measurement. Accuracy signifies how close a measurement is to its true value. This is essential because bad instrument, poor data processing or human mistake can lead to incorrect results that are not very nearby to the accurate one. Precision is how close a series of measurements of the same thing are to each other. Measurements that are imprecise do not properly identify random errors and can produce a widespread result.

In research, new innovations are possible only by doing the accurate and precise measurements. Otherwise the whole research will not be used or considered for the corresponding work. To get accurate and precise results, the instrument to be calibrated by comparing with the reference material. The reference materials (RMs) play crucial role in sustaining quality infrastructure of any economy through testing and calibration with precise measurements traceable to SI units. RMs are the materials that are described by the peculiar properties like homogeneity and stability. These can be adequately used for calibrating the measuring equipment's, assess computational methods and expressed material characteristics. A RM can be referred as certified RM (CRM) by performing successive completion of certification procedure. RMs should have the following general requirements: (1) stability (2) homogeneity (3) Analyte content evaluated with appropriate accuracy and precision (4) Each certified value associated to an uncertainty with a certain confidence level (5) Cohesive documentation/ certificate. In CRMs each component is certified individually and having its own certified value accompanied by declaration of the measurement uncertainties known as standard deviation, it also has a good assessment of uncertainties arising from systematic errors for which corrections should be applied. The accuracy and precision of these measurements is determinate upon an established set of necessities. One institution may need low accuracy measurements while another may require high accuracy as per data requirement. No matter how careful or exact, every measurement outcome comprises an independent amount of uncertainty. Therefore, if measurement is important, then measurement uncertainty is likewise important. According to the NIST, no measurement is complete without an accompanied declaration of the related amount of uncertainty.

Figure.1

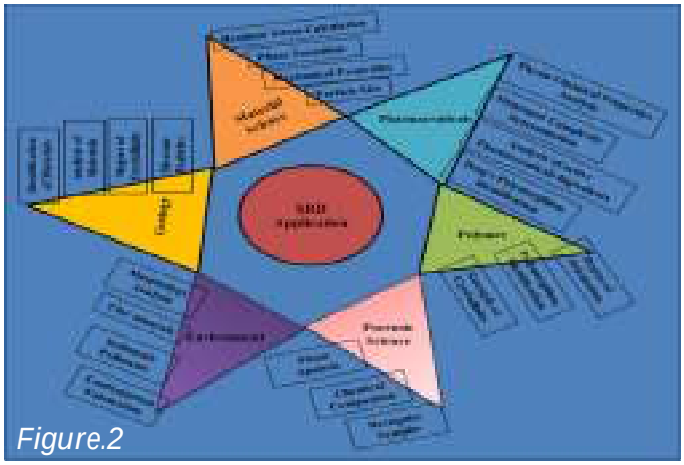
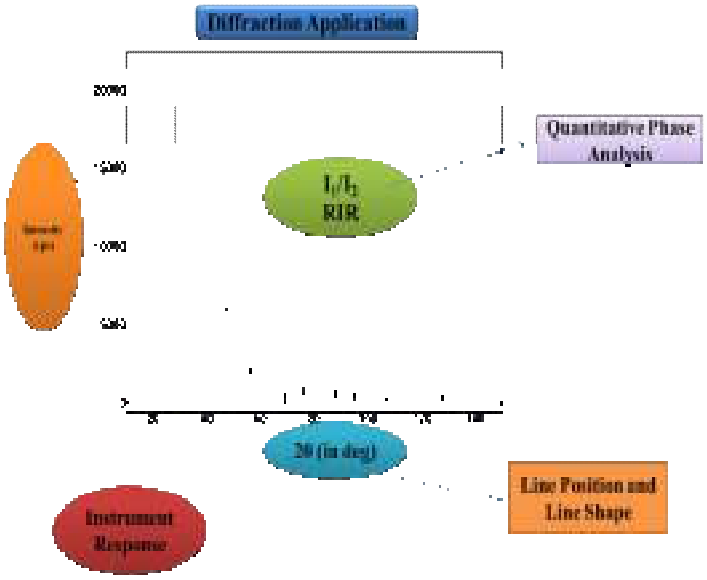


Figure.2

There are many sources for uncertainty in measurements like equipment, operator, method, calibration and environment which are the common contributor's .Now International Bureau of weights and Measures (BIPM) and International Laboratory Accreditation Cooperation (ILAC) defines that "Calibration and Measurement Capability (CMC)" should be provide to customers under standard circumstances. While declaring a CMC, the measurement and calibration should be carried out in agreement with a documented procedure having an uncertainty budget linked with the activity. There are following contributors to CMCs uncertainty like repeatability, resolution, reproducibility, reference standard uncertainty, environmental factors. CMCs uncertainty shall include significant contributors which may be required by method / procedure and apply to measurements.

India is a member of group of national metrology institutes (NMIs) all over the Asia Pacific region represented by Asia Pacific Metrology Programme (APMP). APMP was organized in order to exchange ideas and knowledge between the all NMIs. National Measurement Institute of India is CSIR-NPL and also a custodian of National Standards. CSIR-NPL is based on its strength and expertise in accurate measurements. Indian Reference Materials Division (Bharatiya Nirdeshak Dravya: BND®) is involved in preparation and dissemination of reference material at low cost which helps to improve the quality infrastructure in India. Precise and accurate measurements, indirectly helps to improve our scientific outcome and also reflects in countries economy. Recently CSIR-NPL has launched the α-Al_2O_3, an Indian reference Material (BND) for calibrating PXRD on 4th January 2020 during AdMet conclave. One can see the BND price and detailed purchase procedures from (http://www.nplindia.in/bhartiya-nirdeshak-dravya-bnd-indian-reference-materials) the website. The some photograph related to launched material with the BND® emblem is shown in Fig.1. In general a powder X-ray diffraction pattern consists of 2θ or line position in x axis and intensity as y axis. One can see carefully the observed PXRD pattern, there are different parameters (Fig. 3) are involved such as line position (d position) and line shape, intensity, full width at half maximum (FWHM) and quantitative phase analysis. The quantitative analysis in which reference intensity ratio (RIR) is used to determine the quantitative mineralogy of rock samples is also important factor for powder X-ray diffraction. If the instrument is not calibrated, the above said parameters will affect the instrumental response and may lead to wrong results. PXRD reference materials will improve the measurement accuracy and ensure the expected outcome of the synthesized product/compound. BND® division of CSIR-NPL is continuously working for preparation and development of Silicon powder as an Indian Reference Material (BND®).



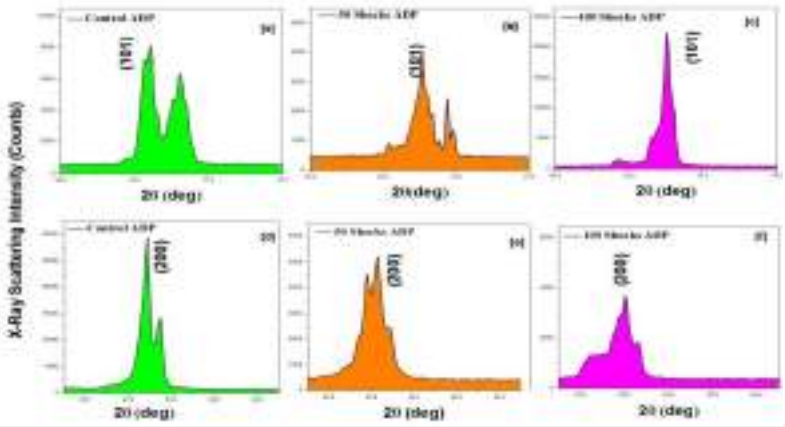
Use of Si standard in powder diffraction assessment has proven beneficial for reducing systematic errors in 2θ due to divergence, sample displacement, absorption and calibration errors. If the PXRD instrument is properly calibrated, the outcome of the results will help in different fields of physical, chemical, engineering and biological in which powder X-ray diffraction instrument is an important tool for determination of various parameters like lattice dimensions, phase identification, stress, strain, crystallite size and characterize precipitates of various minerals etc.

Shock Waves – A fascinating tool for Materials Science Research

A. Sivakumar, S. A. Martin Britto Dhas*
Department of Physics, Abdul Kalam Research Center, Sacred Heart College,
Tirupattur-635601, Tamil Nadu, India

In recent years, investigation of interaction of shock waves on crystalline and non crystalline materials is getting widespread and remarkable attention by materials science researchers. Since shock wave recovery experiments induce micro and macro structural changes in crystalline materials, structure- related properties such as thermal, electrical, optical and magnetic properties of the materials are significantly altered based on the materials properties. Because of this reason, shock wave recovery experiments are very much essential to be performed so as to understand the structural properties at high temperature and high pressure environments. Moreover, investigations on structural properties have lot of fundamental academic interest and industrial applications.

Here we have presented the ammonium dihydrogen phosphate (ADP) crystal structure response at shock wave loaded conditions and observed XRD results are presented in Figure.1. At 50 shocks loaded conditions, the intensity of shoulder peak is reduced whereas (101) peak intensity is increased and similarly at 100 shocks loaded condition the shoulder peak is completely destroyed and converted into (101) plane. Hence, the peak intensity is increased remarkably. When we increased the number of shock waves, the degree of re-crystallization is also increased for the (101) plane. Hence, the full width half maximum is significantly reduced at 100 shock waves loaded crystal. From the observed results, it is very much evident that the applied shock waves have enhanced the degree of crystalline nature of the (101) phase (pyramidal face). As far as the (200) plane (prismatic face) is concerned it is drastically reduced by the impact of shock waves, which means that the degree of crystalline nature is reduced due to shock wave impacts. During the shock wave loaded conditions, there is a possibility in which the crystal would have generated structural defects, dislocations, void nucleation and so on. In the present case, the pyramidal face of ADP crystal has undergone remarkable enhancement in terms of degree of crystalline nature by the impact of shock waves. But, opposite response is noticed in prismatic face. Followed by ADP crystal, GI crystals' structural properties have been investigated and obtained XRD pattern is presented in Figure.2. Interestingly the intensities of diffraction peaks were significantly altered in 50 shocks loaded condition. The prominent peaks (21-1) and (131) are getting remarkable enhancement of crystallinity due to the impact of shock waves whereas the rest of the planes are experiencing rapid downward trend.



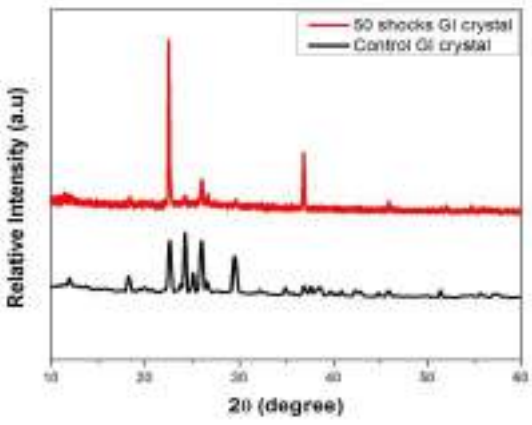


Figure.1 *XRD profiles of control and shock wave loaded ADP crystal (101) and (200) planes*
Figure.2 *XRD profiles of control and shock wave loaded GI crystal*

Indigenously developed high precision Crystal Growth Puller
Crystal Growth Systems – Design and Development Lab

RAANA SEMICONDUCTORS PVT LTD, Hosur-635109, Tamil Nadu, India
E-mail: rajasekar@raana.in; Mobile: +91 9994857099

This Indigenously Developed Crystal Growth Puller System with Precise Control options for Translation and Rotation Movements is highly suitable for growing quality single crystals using the Czochralski and Bridgman Technique with necessary customizations. Translation Pull Rate & Rotation Speed with negligible vibrations being a major factor in Crystal growth, this system is designed with such precise control options with achievable Minimum Translation Pull Rate of 0.5 mm/day to Maximum of 30 mm/hr along with the Rotation Speeds of 0.1 RPM to Customizable Maximum Speed of $\geq$ 30 RPM. These operations are achieved with the help of Custom Programmed - Specially Designed Motor Driver Circuits. With Pull Length of 500 mm and Transportable Mass of 10 kg, fast forward mode operation at the speeds of 30 mm/60 mm/90 mm/120 mm per minute can also be performed using the Remote Control. With Pull Length of 500 mm and Transportable Mass of 10 kg, fast forward mode operation at the speeds of 30 mm/60 mm/90 mm/120 mm per minute can also be performed.

High Precision Crystal Growth Puller and Control Unit

The Furnace is a vertical zone tube furnace that is designed for a maximum temperature of 1100^{0}C, with total dimensions not exceeding 600 mm x 600 mm with inner tube diameter of 100 mm and the Hot Zone Length 250 mm. The Furnace is Hot face Insulated by Various grades of Ceramic Fibre Blanket. Fusing unit is embedded to prevent the heater coil from high current and short circuits.

Figure.1 (a) *Schematic Diagram of the Crystal Growth Puller,* ***(b)*** *High Temperature Furnace Control Unit,* ***(c)*** *High Temperature Furnace*

CRYSTAL GROWTH RESEARCHERS IN INTERNATIONAL LABORATORIES

Dr . M. Magesh
Post Doctoral Fellow
C/o Prof. Chun Wei Chen
Department of Materials Science
National Taiwan University (NTU)
Taiwan
Email: mage.radha@gmail.com

Dr. RO. MU. Jauhar
Post Doctoral Fellow
C/o Prof. Chen Weil
Institute of Intelligent Manufacturing Technology, Shenzhen Polytechnic University, China
Email: jauharphysicist@gmail.com

Dr. Logu Thirumalaisamy
Postdoctoral Researcher
C/o Prof. Y. Okada
Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan
Email: astrologu10@gmail.com

Dr. K. Mohanraj
Research Fellow
C/o Dr. Chi-Yen Huang
Graduate Institute of Photonics
National Changhua University of Education, Taiwan
Email: mohan1991mpt@gmail.com

Mr. V. Govindan
Visiting Research Fellow
C/o Dr. Hong Joo Kim
The Center for High Energy Physics
Kyungpook National University
South Korea
Email: govidurai.vlm@gmail.com

Mr. M. Sathish Kumar
Visiting Doctoral Fellow
C/o Dr. Uwatoko Yoshiya
Institute Of Solid State Physics (ISSP)
The University of Tokyo
Japan
Email: sathiskumar.iaf@gmail.com

Indo-Korea collaboration work for the development of a new thallium (Tl) based fluoride scintillator single crystals for Radiation Detection and Medical Imaging applications

D. Joseph Daniel[1]*, V. Govindan[2], K. Sankaranarayanan[2], H.J. Kim[1]

Institute of High Energy Physics, Kyungpook National University, Daegu-41566, South Korea

Department of Physics, Alagappa University, Karaikudi-630003, Tamil Nadu, India

A large number of metal halide crystals have been developed and some of them have been well-known to be very efficient scintillating materials. Particularly, bromides and iodides based scintillators are most perspective, such as SrI_2:Eu, CsI:Tl, and $LaBr_3$:Ce. These crystals have high light outputs (up to 100000 ph/MeV for SrI_2-Eu), good energy resolution, and high-energy proportionality. The major disadvantage of these scintillators is the handling difficulty due to their highly hygroscopic nature making them to be sensitive with air and moisture. Moreover, these Fluorides possess the additional advantages of low refractive index, good thermal and mechanical stability. However, the single crystal growth process of fluorides needs specific experimental conditions due to the strong reactivity of the fluorine with oxygen and forms the complexes such as hydroxyl radicals, which efficiently substitute for the ions in the crystalline structure. Nevertheless, no experimental investigation on the Tl based Fluoride single crystal scintillator research has been carried out yet. The main aim of this project is to develop some new Thallium based and mixed fluoride scintillator single crystals for radiation detection application. However, a very few Tl-based scintillators have been only studied and reported so far. At present, we are working on the investigations of $TlAlF_4$ crystal scintillation properties, which has promising scintillation and luminescence properties. At room temperature, the broad emission band is observed under both excitation (236 and 227 nm) bands with the maximum of 390 nm, which is responsible for Tl^+ ion. At 10 K, there is a new band of self-trapped exciton emission with clear separation of Tl^+ emission at higher wavelength region. $TlAlF_4$ exhibits very strong intrinsic emission under the excitation of an X-rays, which is comparable with reference crystal LYSO.

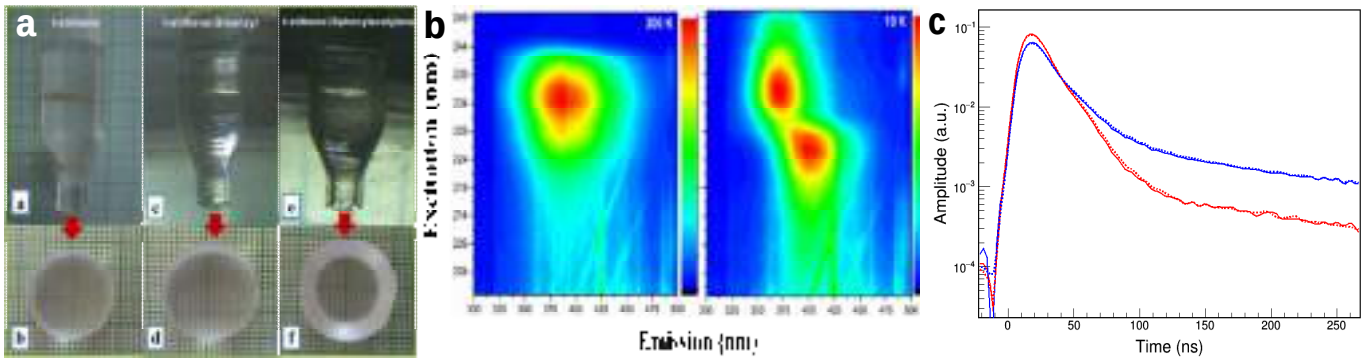


Figure.1 (a) *SR method grown t-stilbene crystals,* ***(b)*** *2D PL emission spectra of TlAlF4 at 300 and 10 K and* ***(c)*** *Scintillation decay time profiles*

There is a significant different between the decay time profiles of gamma rays (blue) and neutron (red) for Bibenzyl (solid) and Diphenylacetylene (dotted) composite t-stilbene crystals. The light yield of the t-stilbene:Diphenylacetylene crystal is equal to 86.5% of t-stilbene:Bibenzyl single crystal. Relative light yield comparison has been performed by fitting the Compton edge of ^{137}Cs source measured with both crystals. The charge comparison method has been employed to study the PSD capability. The FOM value was calculated to quantify the separation ability between neutron and gamma rays. The figure of merit of this crystal was 3.3 and in the case of t-stilbene:Bibenzyl composite crystal was 3.5.

BEST PAPER PRESENTATION AWARDS IN XXIII NSCGA-2019

P. Sampath Kumar, Bharathiar Univ. received **Dr. RG National Award for BEST THESIS** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

V. Govindan, Alagappa University received **Dr. RG National Award for BEST THESIS** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

S. Kotteswaran, SSN Institutions received **Dr. RG National Award for BEST THESIS** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

P. Vijaya Kumar, IGCAR, Kalpakkam received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

B. Srikanth Ragunath, SASTRA University received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

L. R. Keerthi, CCG, VIT University, Vellore received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

BEST PAPER PRESENTATION AWARDS IN XXIII NSCGA-2019

S. Anand, CCG, VIT University, Vellore received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

M. Avinash Kumar, SSN Institutions, Chennai received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

S. Sanmugavel, SSN Institutions, Chennai received **BEST ORAL AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

D. Karthick Raja, Periyar University, Salem received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

S. Muniyappan, Pachiyappa's College, Chennai received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

S. S. Ajieth Kanna, PSG College of Technology, Coimbatore received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

BEST PAPER PRESENTATION AWARDS IN XXIII NSCGA-2019

T. Kamalesh, SSN Institutions, Chennai received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

M. Manikandan, SSN Institutions, Chennai received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

G. Anbu, SSN Institutions, Chennai received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

V. Jabha Anandhi, SSN Instituions, Chennai received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

Sawthi Somanathan, Anna University received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University during 28-30 January 2019

R. Hari Ram Prasath, MK University received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth held at Bharathiar University, Coimbatore during 28-30 January 2019

S.V. Baageshri, St. Joseph's College, Trichy received **BEST POSTER AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

P. Sampath Kumar, Bharathiar University received **BEST CRYSTAL DISPLAY AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

K. Mariselvam & N. Ravikumar, PSG College of Technology received **BEST CRYSTAL DISPLAY AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

P. Karuppasamy & T. Kamalesh, SSN Institutions received **BEST CRYSTAL DISPLAY AWARD** in the XXIII National Seminar on Crystal Growth (XXIII NSCGA-2019) held at Bharathiar University, Coimbatore during 28-30 January 2019

U. Rajesh Kannan, Aditanar College, Tiruchendur received **BEST ORAL AWARD** in the NSRAPS-2019 held at Department of Chemistry and Physics, Rani Anna Govt. College for Women, Tirunelveli during 18-19 March 2019

D. Shanthi, Aditanar College, Tiruchendur received **BEST POSTER PRESENTATION AWARD** in the REDEEMS-2019 held at Department of Physics, Sarah Tucker College, Tirunelveli on 1st February 2019

Ph.D. THESES IN CRYSTAL GROWTH (2019)

S.No	Name of the student	Title of the Ph.D. Thesis	Supervisor & Affiliation
1	Ashraf Ali. A	Investigation of low energy and swift heavy ions on the optical and electrical properties of silicon carbide	Dr. J. Kumar Crystal Growth Centre, Anna University, Chennai-600025
2	Aarthi. J	Studies on Crystal Growth, Optical and Biological Applications of L-glutamic Acid Polymorphs and Its Derivatives	Dr. P. Dhanasekaran Bharathiar University Arts and Science College, Erode-638104
3	Aarthi.R	Structural, spectral and optical analysis of some 4-methylbenzylamine based crystals	Dr. C. Ramachandra Raja Government Arts College Kumbakonam-612002
4	Anbarasi. A	Investigations on the growth and characterization studies of thiourea monoacetate (TMA), thiourea potassium hydrogen phthalate (TKHP), BTAN and bis (thiourea) barium nitrate (BTBN) NLO crystals	Dr. S. M. Ravi Kumar Department of Physics Government Arts College Tiruttani-631209
5	Arockia Avila. S	Studies on the growth and characterization of aminoacid based nolinear optical single crystals for electro-optical applications	Dr. A. Leo Rajesh St. Joseph's College Tiruchirappalli-620002
6	Arputha Latha. A	Synthesis and characterization of organic nonlinear optical crystals for optoelectronic and photonic applications	Dr. M. Anbuchezhiyan SRM Valliammai Engineering College., Chennai-603203
7	Attralarasan. S	Computational and experimental characterization of BLZC, BNA, LARM, LAM and LPB nonlinear optical single crystals	Dr. J. Madhavan Loyola College Chennai-600034
8	Bagavath. C	Investigation on GaN, InN, InGaN materials and Electrochemical Applications	Dr. J. Kumar Crystal Growth Centre, Anna University, Chennai-600025
9	Deepa. K	Crystal growth and theoretical insight on selected organic nonlinear optical single crystals	Dr. J. Madhavan Loyola College, Chennai-600034
10	Divya Bharathi. M	Synthesis, growth, Structural, Vibrational, Thermal, Mechanical and Third Order NLO Properties of Organic Single Crystals	Dr. G. Anbalagan University of Madras Chennai-600025
11	Durairaj. N	Investigation on organic scintillator crystal for neutron-gamma discrimination and fast neutron detection application	Dr. S. Kalainathan Vellore Institute of Technology Vellore-632014
12	Goldy Slathia. S	Growth, characterization and properties of rare earth coordinated crystals	Dr. K. K. Bamzai University of Jammu Jammu-180004
13	Jaydeep H. Joshi	Growth and characterization of some amino acid doped ADP crystal	Dr. Ketan D. Parikh, Shri M.P.Shah Arts & Science College, Gujarat-363002
14	Jebin. R. P	Growth and charcteization of Benzaldehyde derivative single crystals for optical applications	Dr. T. Suthan Noorul Islam University Kanyakumari-629180
15	Justin. P	Investigations on some organic crystals towards nonlinear optical applications	Dr. K. Anitha Madurai Kamaraj University Madurai-625021
16	Kajamuhideen. M. S	Growth of Diphenylguanidine complex, Triphenylguanidine and B2ABM phthalate single crystals for efficient nonlinear optical application	Dr. K. Sethuraman Madurai Kamaraj University Madurai-625021
17	Kalaimani.N	Synthesis, growth and characterization of some organic and semiorganic nonlinear optical crystals	Dr. C. Ramachandra Raja Government Arts College Kumbakonam-612002

18	Karthick. S	Investigations on certain organic single crystalline materials for nonlinear optical and terahertz applications	Dr. S. Brahadeeswaran Department of Physics BIT Campus, Anna University, Tiruchirappalli-620024
19	Manivannan. M	Growth and characterization of 4- Dimethylamino-N-methyl-4-Stlibazolium Tosylate (DAST) Crystal for Photonic Applications	Dr. M. Jose Sacred heart College Tirupattur-635601
20	Mary anjalin. F	Structural, spectroscopic and hirshfeld surface analysis of P-Nitroanilinium P-Toluene Sulphonate, Anilinium Malonate, Anilinium Arsenate and Anilinium Hydrogen Oxalate Hemihydrate - crystals of Aniline family	Dr. N. Kanagathara Department of Physics Saveetha School of Engineering Chennai-602105
21	Mohana. J	Investigation on the growth, structural, non-linear optical properties of Quinoline and Pyrrolidine based crystals	Dr. G. Anbalagan University of Madras Chennai-600025
22	Mugundakumari. S	Investigation on some pure and doped NLO active organometalic crystals	Dr. N. Joseph John Government Arts College Nilgiris-643002
23	Packiya Raj. M	Investigations on the synthesis, growth and physicochemical properties of SMTC, SCTC and SMGTC - the promising inorganic nonlinear optical crystals	Dr. S. M. Ravi Kumar Department of Physics Government Arts College Tiruttani-631209
24	Pradeep. S	Implantation and irradiation studies on MOCVD Growth of InGaN, AlInGaN and Sapphire substrate	Dr. K. Baskar Crystal Growth Centre, Anna University, Chennai-600025
25	Prabhu. P	Growth and characterization of some organic and semiorganic nonlinear optical crystals.	Dr. C. Ramachandra Raja Government Arts College Kumbakonam-612002
26	Priyadharshini. A	Growth and characterization of third order nonlinear optical single crystal	Dr. S. Kalainathan Vellore Institute of Technology Vellore-632014
27	Rajesh Kannan. U	Characterization of some bulk crystals grown by slow evaporation technique for NLO applications	Dr. P. Selvarajan Aditanar College of Arts and Science, Tiruchendur-628216
28	Rajeswari. A	Investigation on growth and characterization of Guanidinium based semiorganic single crystals for nonlinear optical applications	Dr. P. Murugakoothan Department of Physics C.Kandaswami Naidu College For Men, Chennai-600102
29	Ravikumar. N	Growth and characterization of borate single crystals with near biological tissue-equivalency for Dosimetric applications	Dr. R. Arun Kumar Department of Physics PSG College of Technology Coimbatore-641004
30	Reena Devi.S	Investigation on the growth aspects, structural and nonlinear optical properties of 4-methylpyridinium derivative crystals	Dr. R. Mohan Kumar Department of Physics Presidency College Chennai
31	Sanjay. S	Growth and Characterization of Gallium nitride microstructures on sapphire, Gallium nitrate and Graphene substrates by chemical vapour deposition	Dr. K. Baskar Crystal Growth Centre, Anna University, Chennai-600025 Tamil Nadu
32	Sampathkumar. P	Crystal growth and investigation of Triglycine Sulphate family single crystals for the fabrication of Pyroelectric Infrared detrectors and Polymorphic investigation of Diisopropyl ammonium Chloride Hemihydrate	Dr. K. Srinivasan Department of Physics Bharathiar University Coimbatore-641046

33	Samsom .Y	Synthesis growth and characterization studies of NASA, FASA, SAPA and SALA NLO crystals	Dr. D. Prem Anand St Xavier college Palayamkottai-627002
34	Saranraj. A	Crystal growth and characterization for photonic applications	Dr. S. A. Martin Britto Dhas Sacred Heart College Tirupattur-635601
35	Shalini. S	Growth, characterisation and theoretical investigations on 4-dimethylamino pyridinium P-chlorophenolate and dimethylamino pyridinium P-bromo-chlorophenolate single crystals	Dr. S. Shahil kirupavathy Department of Physics Velammal Engineering College Chennai-600066
36	Shek Dhavud. S	Growth and characterization of semi-organic nonlinear optical single crystals with some dopants	Dr. J. Thomas Joseph Prakash Government Arts College Trichy-620022
37	Shiny Febena. A	Investigations on NLO active Glycine based single crystals: a DFT and Spectroscopic approach	Dr. J. Madhavan Loyola College Chennai-600034
38	Sonia	Growth and characterization of L-arginine based single crystals for nonliinear optical applications	Dr. N. Vijayan CSIR-National Physical Laboratory, New Delhi-110012
39	Subha. M	Structure elucidation and characterisation studies on new organic complexes of 2-Amino Benzothiazole and Hydroxy Pyridine	Dr. K. Anitha Madurai Kamaraj University Madurai-625021
40	Sudha. N	Crystal growth, characterisation, DFT studies on organic salts and Schiff base compounds for NLO applications	Dr. R. Mathammal Sri Sarada College for Women Salem-636016
41	Sudhakar. K	Investigation on growth and physico-chemical properties of some nonlinear optical single crystals	Dr. P. Murugakoothan C. Kandaswami Naidu College For Men, Chennai-600102
42	Tamil Elakkiya. M	Structural, spectral and computational studies on biologically significant Diazine derivatives	Dr. K. Anitha Department of Physics Madurai Kamaraj University Madurai-625021
43	Thilakavathi. G	Influence of L-Threonine on the growth, structural, mechanical and nonlinear optical properties of L-Tartaric acid, L-Tartaric acid nicotinamide and Thiourea single crystals	Dr. R. Arun Kumar Department of Physics PSG College of Technology Coimbatore- 641004
44	Thirupthy. J	Thermophysical properties of few crystalline materials	Dr.S.A.Martin Britto Dhas Department of Physics Sacred Heart College Tirupattur-635601
45	Varalakshmi. S	Investigation on the synthesis, growth and physiochemical properties of Glycine barium nitrate (GBN), L-arginine sodium nitrate (LARSN), L-alanine sodium nitrate (LASN), L-histidine barium nitrate (LHBNL) – the promising NLO crystals of amino acid family	Dr. R. Ravisankar Department of Physics Government Arts College Thiruvannamalai
46	Vijayalakshmi. V	Influence of various metal ions on the growth and Characterization of Glycine Polymorphs and their nonlinear optical and biological applications	Dr. P. Dhanasekaran Department of Physics Bharathiar University Arts and Science College, Erode-638104
47	Umarani. P	Impact of charge transfer interactions and the hydrogen bond influence of 4-methoxybenzylammonine derivatives for frequency conversion and optical limiting applications	Dr. C. Ramachandra Raja Department of Physics Government Arts College Kumbakonam-612002

FORTH-COMING EVENTS IN CRYSTAL GROWTH (2020)

- 8th International Workshop on Crystal Growth Technology (VIII IWCGT-2020), 14-18 June 2020, Leibniz Institute for Crystal Growth, Max-Born Str. Berlin/Germany **Web:** https://iwcgt-8.ikz-berlin.de/
- The 27th AACGE Western Section Conference on Crystal Growth and Epitaxy, 14-17 June 2020, Stanford Sierra Camp in Fallen Leaf Lake, CA, USA, **Web:** http://hstrial-snash0.homestead.com/AACGE-27---West-Section-Conference-.html
- Mini-symposium MS425: Computational modeling of growth and processing of single-crystal materials and the 8th ECCOMAS 2020, July 19-24, 2020, Paris, France **Web:** https://www.wccm-eccomas2020.org/frontal/
- 2nd Joint Meeting of the Young Crystallographers (DGK) and the Young Crystal Growers (DGKK), 4-6 October 2020, Freiberg University of Mining and Technology **Web:** https://dgk-home.de/aks/jkyc /freiberg-2020/;
- 21st International Symposium on Industrial Crystallization (XXI ISIC-2020), 8-11 September 2020, Max-Planck Institute of Magdeburg, Potsdam, Berlin, Germany **Web:** https://dechema.de/en /ISIC_21.html
- 6th European Crystallographic School to be held in Budapest, Hungary, 5-11 July 2020 is association with European Crystallographic Association and International Union of Crystallography (IUCr), **Web:** https://www.ecs6.chemcryst.hu/
- 7th International School of Crystallization: Pharmaceuticals, Foods, Agrochemicals, Minerals, New Materials (ISC-2020), 24-29 May 2020, University of Granada, Granada, Spain, **Web:** https://iscgranada.org
- International Conference on Crystallography, Crystallization and Crystal Growth (ICCCCG 2020), June 18-19, 2020, University of Toronto, Toronto, Canada **Web:** https://waset.org/- crystallography –crystallization-conference-in-june-2020
- The 8th Asian Conference on Crystal Growth and Crystal Technology (8th ACCGCT-2020), 19-22 October 2020, Tokyo University, Miyazaki, Japan **Web:** https://www.cgct-8.com/
- Italian Crystal Growth (ICG-2020)- Crystal Growth: From Theory to Application (CGTA-2020), 1-2 October 2020, University of Torino, Torino, Italy **Web:** https://www.icg2020.net/
- 2nd Indian Materials Conclave and 31st Annual General Meeting (AGM) of Materials Research Society of India, Kharagpur Chapter, 11-14 February 2020, Saha Institute of Nuclear Physics, Kolkata-700064, **Web:** https://www.mrsiagm2020.org/

CONFERENCE HIGHLIGHTS

XXIII National Seminar on Crystal Growth and Applications (XXIII NSCGA-2019), 28-30 January 2019

Department of Physics, Bharathiar University, Coimbatore-641046, Tamil Nadu

The Department of Physics, Bharathiar University has organized 23rd National Seminar on Crystal Growth and Applications (NSCGA-2019) in association with Indian Association of Crystal Growth (IACG) during 28-30th of January 2019. This Seminar was funded by DST-SERB- New Delhi, DAE-BRNS- Mumbai, CSIR-New Delhi and Bharathiar University, Coimbatore. The event was inaugurated on 28th January 2019 at Dr. Usha Kirtilal Mehta Convention Centre, Bharathiar University. Dr. K. Srinivasan, Convener-NSCGA-2019 has welcomed the gathering. Dr. N. Jeyakumar, Member Vice-Chancellor Committee, Bharathiar University has delivered the presidential address and Dr. P. Kolandaivel, Vice-Chancellor, Periyar University has served as a Guest of Honour of the event. The Special address was given by Dr. D. Arivuoli, Anna University and Dr. Feffrey J. Derby, McKnight University, University of Minnesoa, USA has delivered the Inaugural address of the event. The seminar was felicited by Dr. G. Bhagavannarayana, former Chief Scientist & Head, Crystal Growth Division, CSIR-NPL, New Delhi, Dr. S. C. Gadkari, Outstanding Scientist & Head, Crystal Technology Section, BARC, Dr. Binay Kumar, University of New Delhi and Dr. R. Jayavel, Anna University, Chennai.

We have invited about 65 eminent scientists working in the area of crystal growth to deliver the invited talk in NSCGA-2019, among which 35 invited lectures has delivered their talk in the field of crystal growth and applications in the three days of the national seminar. On the whole we have received about 105 and 50 abstracts for poster and oral presentations, 12 theses for thesis presentation and 10 applications for crystal display. Among which 80 participants has presented their posters and 43 has presented their papers (oral) on the first two days of the seminar. Eight participants has presented their thesis on the field of crystal growth on the first day of the seminar and 14 participants has displayed their grown crystals on the second day of the seminar. The three days seminar ended with valedictory function on 30th January, 2019 at 04.30 pm with the valedictory address by Prof. P. Ramasamy, President IACG followed by Dr. R. N. Rai, Banaras Hindu University, Dr. K. K. Bamzai, University of Jammu, Dr. S. Kalainathan, VIT Vellore and Dr. S. Balakumar from University of Madras. Awards were given for 15 best poster presentations, 10 best oral presentations, 3 best thesis presentations, 4 best crystal displays and 5 best interacted participants. A total of 200 researchers from seven different states of the country participated in the seminar.

Prof. K. Srinivasan, Convener, NSCGA-2019
Head, Department of Physics, Bharathiar University, Coimbatore-641046, Tamil Nadu

International Symposium on Modeling of Crystal Growth Processes and Devices (MCGPD-2019), 26-28 February 2019

SSN Research Centre, SSN Institutions, Chennai-603110, Tamil Nadu

The International Symposium on Modeling of Crystal Growth Processes and Devices (MCGPD-2019) was organized by SSN Research Centre, SSN Institutions in association with the International Organization for Crystal Growth (IOCG), Indian Association for Crystal Growth (IACG) and Indian Science and Technology Association (ISTA) during February 26-28, 2019. Three days international symposium was highly propitious for the researchers who are working in the field of modeling and simulation of various crystal growth processes, semiconductor devices, NLO, and piezoelectric devices. The ultimate goal of the symposium was to give about the fundamental understanding of modeling prospects to the young researchers in exploring the recent and advanced developments. The symposium included 26 Keynote/ Invited lectures by eminent experts from foreign and Indian institutions. Around 170 posters/oral presentations from the researchers were presented. Professors/Scientists from leading crystal growth countries like Japan, Germany, France, Russia, Taiwan participated and presented their work in the symposium.

The three days symposium was conducted in ELEVEN technical sessions, which were constituted with ONE Keynote lecture, SIX Plenary talks, NINETEEN Invited lectures and ONE SEVENTY post/oral presentations. The symposium was started with a welcome address by Prof. P. Ramasamy, following that the symposium was inaugurated with the release of MCGPD-2019 abstract book by Prof. Koichi Kakimoto and felicitated by Prof. Mathis Plapp, Editor, Journal of Crystal Growth and Prof. Jyh-Chen Chen, Taiwan. After the Inaugural function, Dr. Koichi Kakimoto delivered an impressive keynote lecture. The second day of the symposium was started with professor Dr. Jyh-Chen Chen. Fourth Plenary lecture was given by Prof. Danial Vizman. Followed his talk, 8 invited talks were given by various national and international speakers from various leading institutes/Universities. End of the second day, 25 young researchers were given an oral presentation at the final session. The third day of the symposium was started with a brief discussion of national science day by Dr K. Gunasekaran, University Madras. After his lecture, Five invited talks were given by eminent professors from various laboratories national and International. Towards the end of the symposium, Dr. V. Subramanian, CLRI-CSIR, had given the final keynote lecture. After his talk, the valedictory function was conducted. Prof. Koichi Kakimoto, President, IOCG, and Prof. P. Ramasamy, President, IACG awarded the Best paper award for oral and poster presentation.

Dr. M. Srinivasan, Convener, MCGPD-2019
Research Scientist, SSN Research Centre, SSN Institutions, Chennai-603110, Tamil Nadu

Indian Laser Association (ILA) Course on Laser and NLO Materials: Development and Characterization in association with Indian Association for Crystal Growth (IACG), 6-7 January 2020

Department of Physics, VIT, Chennai-600127, Tamil Nadu

The Indian Laser Association (ILA) is an association of persons interested in laser technology and applications. The ILA Course on Laser and Nonlinear Optical (NLO) Materials: Development and Characterization was organized by Department of Physics, School of Advanced Sciences, Vellore Institute of Technology (VIT), Chennai in association with Indian Association for Crystal Growth (IACG) during 6-7 January 2020. Two days ILA course was highly propitious for the researchers who are working in the field of crystal growth, characterization, modelling and applications. The ultimate goal of the course was to give the fundamental understanding of crystal growth process, methods, characterization techniques, applications and modelling prospects to the Ph.D scholars and faculty members in exploring the recent and advanced developments. The objective of the course was to provide an overview of the field of laser & NLO materials, their development and characterization.

The ILA course was started with a welcome address by Dr. Sunil Verma, Scientist-G, RRCAT, Indore following that the ILA course was inaugurated by Dr. Indra Rajasingh, Chair Person, School of Advanced Sciences, VIT, Chennai and felicitated by Dr. Piyush Saxena, Secretary ILA, RRCAT, Indore. Prof. P. Ramasamy, Dean(Research) delivered Chief-Guest address and Dr. G. Vinitha, Co-Convener, NLS-28, VIT, Chennai delivered vote of thanks. After the Inaugural function, Prof. P. Ramasamy delivered the lecture about the Introduction of the course subject and briefly described the topics covered by the Lecturers. Following the first lecture, Prof. S. Moorthy Babu delivered two lectures about Melt growth of crystals for Laser and NLO applications. In the afternoon session Prof. K. Sankaranarayanan delivered two lectures in Bulk and unidirectional growth of organic scintillator materials and its characterizations and Application of TEM in material analysis. In the evening session Prof. Sunil Verma delivered two lectures in Crystal growth fundamentals and interferometric techniques. The second day of the ILA course was started with Prof. R. Jayavel, Anna University, Chennai. Tenth lecture was given by Dr. Radha Perumal Ramasamy, Anna University. Following his talk, lectures were given by Dr. Muthu Senthil Pandian and Dr.M. Srinivasan, SSN Institutions, Chennai. After all the lectures, Hands-on sessions/demonstrations was conducted in SSN Research Centre, SSN Institutions, to provide practical exposure to the students to appreciate the concepts and techniques learnt during the course.

Prof. P. Ramasamy, Course Coordinator
Dean (Research), SSN Institutions, Chennai-603110, Tamil Nadu

International Conference on Recent Advances in Materials Science (ICRAMS-2019), 4-6 February 2019

PG and Research Department of Physics, National College (Autonomous), Tiruchirappalli-620001, Tamil Nadu

The Inaugural function of DST-SERB, BRNS, TNSCST and TANSCHE sponsored Three days International Conference on Recent Advances in Materials Science-ICRAMS 2019, organized by the Physics Department was held on 04.02.2019 at the College Auditorium. Dr. A.T.Ravichandran the Convener of the conference welcomed the gathering. Dr. R. Srinivasan, Member Secretary, Tamil Nadu State Council for Science and Technology, Chennai inaugurated the conference. Prof. K.V. Ramanujachary, Rowan University, Glassboro, NJ, USA, delivered keynote address. His speech was embedded with the affordable and niche materials for our day-today life. Dr.Jaganathan, the International Convener of the conference spoke about the theme of the seminar. Secretary Shri. K.Raghunathan released the book of Abstracts. Prof. P. Ramasamy, SSN Institution, Chennai and Prof. S. Gunasekaran, Dean, St. Peter's University, were honoured with outstanding achievement award in Research.

Prof. K.V. Ramanujachary, Rowan University, USA, Dr. Palani Balaya, National University, Singapore, Dr.Veerakumar, National Taiwan University, Dr. B. Venkatraman, IGCAR, Kalpakkam, Dr. N. Lakshmi Narasiman and Dr. A. Pandi Kumar from CECRI-Karaikudi, Dr. P. Ramasamy, SSN Engineering College, Chennai, Dr.Ariuvoli, Dr.N.Kalkura and Dr.R.Jayavel from Anna University, Dr.S.Gunasekaran, St.Peter's university, Dr.B.M.Nagabhushana, M.S.Ramaiah Institute of Technology, Bengaluru, Dr.Padmanaban, Bengaluru, Dr.Manikandan, Thiruvalluvar University, and our Illustrious alumnus Dr.Jagannathan, Provast, St.Teresa University, West Indies, Mr.L.Venkatraman, MODEC offshore Production Systems, Singapore, Mr.K.Balasubramaniam, Santa Clara Valley USA, Dr.S.Madhu, Srimad Andavan College of Arts and Science, and Dr.K.Sivaji, Madras University delivered Invited talks on different areas of Materials Science. Vice-chancellor of Mother Teresa University Dr.Valli delivered the valedictory address and distributed the prizes and awards for best Oral, Poster and Model presentation. More than 250 research papers were discussed during the three days. More than 250 research scholars, students and faculty members from various parts of our nation participated. Dr.Jagannathan, Provast, St.Teresa University, West Indies and the International Convener of the conference proposed the welcome address. Dr. A.T.Ravichandran the Convener of the conference read the report of the conference and proposed a vote of thanks.

Dr. A. T. Ravichandran, Controller of Examinations
Department of Physics, National College (Autonomous), Tiruchirappalli-620001, Tamil Nadu

CRYSTAL GROWTH PROJECTS-2019

PI: Dr. G. Anandha Babu, Assistant Professor
Department of Physics, SSN College of Engineering
Chennai-603110, Tamil Nadu
Phone: +91-9791137823
Email: anandhababug@ssn.edu.in

Project Title : Development of Bismuth-based complex perovskites piezoelectric single crystals for strategic applications

Funding Agency : SERB **Year :** 2019-2021
Amount : Rs. 40.0 lakhs

PI: Dr. S. Bragadeeswarn, Professor and Head
Department of Physics, University College of Engineering
BIT- Campus, Anna University, Tiruchirappalli-620024
Tamil Nadu, Phone : +91-9442317559
Email: sbrag67@gmail.com

Collaborator: Dr. S. Ganesamoorthy, Scientific Officer-G, Materials Science Group, Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam-603102, Mobile: 9425313104
Email: ganesamoorthy@yahoo.com

Project Title : Investigations on phasematchability in organic nonlinear optical (NLO) single crystals for terahertz generation

Funding Agency : UGC-DAE CSR **Year :** 2019-2021
Amount : Rs. 25.0 lakhs

PI: Dr. R. Nagalakshmi, Associate Professor
Department of Physics, National Institute of Technology (NIT)
Tiruchirappalli-620015, Tamil Nadu
Phone : +91-9443940384
Email: nagaphys@gmail.com

Project Title : Synthesis of organic crystals for Terahertz wave (T-Ray) guiding applications

Funding Agency : CSIR **Year :** 2019-2021
Amount : Rs. 22.58 lakhs

PI: Prof. S. Moorthy Babu
Director, Centre for Nanoscience and Technology
Professor, Crystal Growth Centre (CGC)
Anna University, Chennai-600025, Tamil Nadu
Phone: +91-9443969192
Email: babu@annauniv.edu

Project Title : Development of single crystal Gallium Oxide (Ga_2O_3) growth technology for Power Device applications

Funding Agency : DRDO **Year :** 2019-2021
Amount : Rs. 150.0 lakhs

Project Title : Bulk crystal growth of gallium oxide and fabrication of heterojunction diodes

Department of Sciences & Technology Government of India

Funding Agency : DST-Indo-Sweden **Year :** 2019-2021
Amount : Rs. 740.0 lakhs

PI: Dr. P. Ramesh Kumar, Assistant Professor
Department of Physics, Periyar EVR College
Tiruchirappalli-620023, Tamil Nadu
Phone : +91-9578240141
Email: rameshkumarevr@gmail.com

Project Title : Irradiation effect on the optical properties of borate derivatives based single crystals by vertical Bridgman technique for data storage and other optical applications

Funding Agency : CSIR **Year :** 2019-2021
Amount : Rs. 23.25 lakhs

PI: Prof. Rajendra Singh, Professor
Department of Physics
Indian Institute of Technology, Delhi, New Delhi-110016
Phone : +91-11-26596495
Email: rsingh@physics.iit.ac.in

Project Title : Wide bandgap semiconductor (Al)GaO/Nitrides heterostructures for High Power Electronic and Optoelectronic Devices

Department of Sciences & Technology Government of India

Funding Agency : DST-BRICS **Year :** 2019-2021
Amount : Rs. 150.0 lakhs

PI: Dr. S. Shanmuga Sundari, Assistant Professor
Department of Physics, PSG Krishnammal Arts and Science College for Women, Coimbatore-641004, Tamil Nadu
Phone: +91-6383580855
Email: shanmugi.s@gmail.com

Department of Sciences & Technology Government of India

Project Title : Growth and optical wave guide formation in new glycine phosphate (GPI) based single crystals

Funding Agency : DST-WOS-A **Year :** 2019-2021
Amount : Rs. 27.70 lakhs

Project Title : Growth and characterization of DAST and its derivative crystals for Tetrahertz communications

Funding Agency : GRG Trust **Year :** 2019-2020
Amount : Rs. 5.00 lakhs

PI: Dr. V. N. Vijayakumar, Assistant Professor
Department of Physics
Bannari Amman Institute of Technology
Sathyamangalam-638401, Tamil Nadu
Email: vijayakumarvn@bitsathy.ac.in

TNSCST

Project Title : Design and characterisation of hydrogen bonded crystal for optical applications

Funding Agency : TNSCST **Year :** 2019-2020
Amount : Rs. 4.50 lakhs

PI: Prof.Yatramohan Jana, Professor
Departent of Physics, University of Kalyani
Kalyani-741235, West Bengal
Phone : +91-9830997571
Email: ymjana@klyuniv.ac.in

Project Title : Exploring magneto-caloric effect and spin-frustrated magnetism in some rare-earth based Pyrochlore ($A_2B_2O_7$; A = Rare-earth) and double Perovskite ($A_2B¢B¢¢O_6$; B¢ = rare-earth) crystals towards application in Magnetic Refrigeration

Funding Agency : SERB **Year :** 2019-2021
Amount : Rs. 45.50 lakhs

PI: Dr. S. K. Pandiyan, Assistant Professor
Centre for Nonlinear Science and Engineering
SASTRA University, Thanjavur-613401, Tamil Nadu
Phone: +91-9942115131
Email: krishpandiyan@gmail.com

Project Title : Construction of compact RGB laser system using QPM crystal for display applications

Funding Agency : SERB **Year :** 2019-2021
Amount : Rs. 33.27 lakhs

PI: Dr. R. Ravi Shankar, Assistant Professor
Department of Physics, Government Arts College
Tiruvannamalai-606603, Tamil Nadu
Mobile:+91-9840807356
Email: ravisankarphysics@gmail.com

Project Title : Growth and characterisation of glycine sodium nitrate for nonlinear optical applications

Funding Agency : TNSCST **Year :** 2019-2020
Amount : Rs. 10,000/=

PI: Dr. T. Balakrishnan, Associate Professor & Head
Department of Physics, Periyar EVR College
Tiruchirappalli-620023, Tamil Nadu
Mobile:+91-9443445535
Email: balaphy@rediffmail.com

Project Title : Improvement of the quality of potassium manganese nickel suplhate single crystals for UV filter application

Funding Agency : TNSCST **Year :** 2019-2020
Amount : Rs. 10,000/=

PI: Dr. P. Jagdish, Assistant Professor
Department of Physics Rajah Serfoji Government College
Thanjavur-613005, Tamil Nadu
Mobile:+91-9443762446
Email: jaggpaddy@gmail.com

Project Title : Fabrication and performance analysis of low cost temperature bath for crystal growth

Funding Agency : TNSCST **Year :** 2019-2020
Amount : Rs. 10,000/=

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 and Designation of the Recipients	Institutional Details
2000	**Dr. P. Santhana Raghavan** Managing Director	GT Solar Corporation Limited, USA
	Dr. G. Dhanaraj Scientist	Department of Materials Sciences and Engineering, Stony Brook University, USA
2002	**Dr. R. Dhanasekaran** Professor	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu
2003	**Dr. M. Ichimura** Professor & Head	Dept. of Electrical & Electronic Engg, Nagoya Institute of Technology, Japan
2004	**Dr. K. Sankaranarayanan** Professor	Department of Physics, Alagappa University, Karaikudi-630003, Tamil Nadu
2005	**Dr. R. Gopalakrishnan** Associate Professor	Crystal Growth Laboratory, Department of Physics, Anna University, Chennai-600025, Tamil Nadu
2006	**Dr. C. K. Mahadevan** Professor & Head	Physics Research Centre, Department of Physics, S.T. Hindu College, Nagercoil-629002, Tamil Nadu
2007	**Dr. N. Vijayan** Principal Scientist	Crystal Growth & X-ray Section, National Physical Laboratory, New Delhi-110012
2008	**Dr. S. Moorthy Babu** Professor	Crystal Growth Centre, Anna University, Chennai-600025, Tamil Nadu
2009	**Dr. K. Ramamurthi** Professor & Head	Department of Physics, Bharathidasan University, Tiruchirappalli-620024, Tamil Nadu
	Dr. S. Ganesamoorthy Scientific Officer-F	Crystal Growth Section, LMDDD, DAE-RRCAT, Indore-452013, Madhya Pradesh (M.P.)
2010	**Dr. G. Bhagavannarayana** Chief Scientist & Head	Crystal Growth & X-ray Section, National Physical Laboratory, New Delhi-110012
	Dr. 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-400085, Maharastra
2015	**Dr. K. Byrappa** Vice-Chancellor	Mangalore University, Mangalore-574199, Karnataka
	Dr. A. K. Karnal Scientific Officer-G	Crystal Growth Section, LMDDD, DAE-RRCAT, Indore-452013, Madhya Pradesh (M.P.)
2017	**Dr. Suja Elizabeth** Principal Research Scientist	Crystal Growth Section, IISc, Bangalore-560012, Karnataka
2019	**Dr. K. Srinivasan** Professor & Head	Crystal Growth Laboratory, Department of Physics, Bharathiar University, Coimbatore-641046, Tamil Nadu
	Dr. Muthu Senthil Pandian Research Scientist	SSN Research Centre, SSN Institutions, Chennai-603110, Tamil Nadu

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**- INSPIRE FACULTY Scheme (www.inspire-dst.gov.in)
9. **DST**- Science for Equity, Empowerment & Development (SEED) Division (http://www.scienceandsociety-dst.org/Aboutscheme.htm)
10. **DST**- International Science & Technology co-operation (Indo-French, Indo-US, Indo-German, Indo-China, Indo-Norway) (http://www.dst.gov.in/international-st-cooperation)
11. **DST**- Oriented Research & Technology Development Proposals on Materials for Energy Storage (MES) (http://www.dst.gov.in/)
12. **DST**- **FIST** Program (www.fist-dst.org)
13. **DST**- Partnership for International Research and Education (PIRE) (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819)
14. **DSIR**- Technology Development and Utilization Programme for Women (TDUPW) (www.dsir.gov.in)
15. **DRDO**- Extramural Research Grant (http://www.drdo.gov.in)
16. **ISRO**- Submission of Research proposal (http://isro.gov.in/sponsored-research-respond/submission-of-research-proposal)
17. **IUAC** – Summer Projects for Materials Characterization (http://www.iuac.res.in/)
18. **MNRE**- Ministry of New and Renewable Energy (http://mnre.gov.in/schemes/solar-rd-projects/)
19. **NRB**- Naval Research Board (nrbdrdo.res.in)
20. **SERB**- Core Research Grant (CRG) (http://www.serb.gov.in/emr.php)
21. **SERB**- Science and Technology Award for Research (STAR) (https://serbonline.in/SERB/Star?HomePage=New)
22. **SERB**- Scientific and Useful Profound Research Advancement (SUPRA) (https://serbonline.in/SERB/Supra?HomePage=New)
23. **SERB**- Start-up Research Grant (SRG) (https://serbonline.in/SERB/srg_Instructions?Home)
24. **SERB**- Women Excellence Award (www.serb.gov.in/women.php)
25. **SERB**- Empowerment and Equity Opportunities for Excellence in Science for SC/ST Faculties (http://www.serb.gov.in/emeq.php)
26. **SERB**- Industry relevant Research and Development (http://serbonline.in/SERB/IRR?HomePage=New)
27. **SERB** - Impacting Research Innovation and Technology (IMPRINT)
28. **TNSCST**- Science & Technology Projects (http://www.tanscst.nic.in/stp.html)
29. **UGC**- Start-up Grant for Young Scientist (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)

NATIONAL FELLOWSHIP OPPORTUNITIES

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. **JNMF** - Jawaharlal Nehru Memorial fellowship (http://www.jnmf.in/fabout.html)
12. **JNCASR** - Summer Research Fellowship Programme (http://www.jncasr.ac.in/fe/srfp.php)
13. **Lady Tata Memorial Trust** - Junior Scholarship and Post Doctoral Fellowship (PDF) (https://www.ladytatatrust.org/StaticPageIndia/Awards/7)
14. **MNRE** - National Solar Science Fellowship Programme (NSSFP) (www.mnre.gov.in)
15. **Raman Charpak Fellowship** (http://www.inde.campusfrance.org/en/news/charpak-scholarship-awardees-20132014)
16. **SERB** - Distinguished Fellowship (http://www.serb.gov.in/sdf.php)
17. **SERB** - Women Excellence Award (http://www.serb.gov.in/wea.php)
18. **SERB** - Overseas Post Doctoral Fellowship (http://www.serb.gov.in/opf.php)
19. **SERB** - National Post Doctoral Fellowship (http://www.serb.gov.in/npdf.php)
20. **SERB** - Indo - US Fellowship Program (http://serbonline.in/SERB/indous?HomePage=New)
21. **SERB** - SN Bose Scholar Program (http://serbonline.in/SERB/snbose?HomePage=New)
22. **SERB** - Graduate Student Exchange Programme (http://serbonline.in/SERB/gsep?HomePage=New)
23. **SERB** - Prime Minister's Fellowship Scheme for Doctoral Research (http://primeministerfellowshipscheme.in/Home.aspx)
24. **SERC** – Swarnajayanti Fellowships (http://www.dst.gov.in/scientific-programmes/scientific-engineering-research)
25. **TNSCST** - Young Scientist Fellowship Scheme (http://www.tanscst.nic.in/ysf.html)
26. **TIFR** - ICTS - Simons Post Doctoral Fellowship (PDF) (https://www.icts.res.in/opportunities/simons-pdf-sept-2016)
27. **UGC** -Post Doctoral Fellowship for Women Candidates (http://www.ugc.ac.in/pdfw/)
28. **UGC** -Post Doctoral Fellowship for SC/ST candidates (http://www.ugc.ac.in/pdfss/)
29. **UGC** - Rajiv Gandhi National Fellowship (RGNF) for SC/ST candidates (http://www.ugc.ac.in/rgnf/)
30. **UGC** - Dr. S. Kothari Post Doctoral Fellowship (http://www.ugc.ac.in/)
31. **UGC** - Raman Fellowship for Post Doctoral Research for Indian Scholars in USA (http://www.ugc.ac.in/ramanpdf/)
32. **UGC** - Maulana Azad National Fellowship for Minority Students (http://www.ugc.ac.in/)

PAST CONFERENCES/SEMINARS/WORKSHOPS

Prof. S. Balakumar receiving Memento from **Prof. P. Ramasamy** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. G. Ravi receiving Memento from **Dr. G. Shanmuga Velayutham** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. K. K. Bamzai receiving Memento from **Prof. S. Kalainathan** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. M. Karl Chinu receiving Memento from **Dr. R. Robert** in the RTMMC-2019 held at Department of Physics, Government Arts College, Krishnagiri on 5 April 2019

Dr. R. Ramesh Babu receiving Memento from **Prof. R. Jagannathan** in the ICRAMS-2019 held at Department of Physics, National College during 4-6 February 2019

Dr. R. Jayavel receiving Memento from **Prof. P. Ramasamy** in the ICRAMS-2019 held at Department of Physics, National College during 4-6 February 2019

Dr. S. Ganesamoorthy receiving Memento from **Prof. R.N. Rai** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. E. K. Girija receiving Memento from **Prof. P. Ramasamy** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. D. Arivuoli receiving Memento from **Prof. S. C. Gadkari** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. Binay Kumar receiving Memento from **Prof. G. Bhagavannarayana** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. S. P. Meenakshisundaram receiving Memento from **Prof. Binay Kumar** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University during 28-30 January 2019

Dr. U. Madhusoodanan receiving Memento from **Prof. R. N. Rai** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. N. P. Rajesh receiving Memento from **Prof. S. Balakumar** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. C. K. Mahadevan receiving Memento from **Dr. G. Shanmuga Velayutham** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. R. Ramesh Babu received a memento from Chairman, Theivanai Ammal College for Women (Autonomous), Villupuram during RAMA-2019 held on 6th February 2019

Dr. P. Rajesh receiving Memento from the organizer in the NCRAMS-2019 held at Department of Physics, G.T.N. Arts College, Dindigul during 12 March 2019

Dr. Sunil Verma with **Dr. Muthu Senthil Pandian** and his Ph.D. students during poster presentation in the 28th NLS-2020 held at VIT University, Chennai during 8-11 January 2020

Dr. Indranil Bhaumik receiving Memento from **Prof. R. N. Rai** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. Radha Perumal Ramasamy receiving Memento from **Prof. Narayana Kalkura** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. N. Vijayan, CSIR-National Physical Laboratory (NPL) inaugurated in NCN-2019 held at Department of Physics, LRG Government Arts College for Women, Tirupur during 24-25 January 2019

Prof. K. Jeganathan receiving Memento from **Prof. Narayana Kalkura** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. S. Brahadeeswaran delivering invited talk in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. R. Vidya and **Dr. P. Ravindran** receiving Memento from **Prof. Koichi Kakimoto, Japan** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Prof. S. Uda, Japan receiving Memento from **Prof. P. Ramasamy** in the ICRTAST-2019 held at SSN Research Centre, SSN Institutions, Chennai during 19-21 September 2019

Prof. S. Kalainathan receiving Memento from **Prof. R. N. Rai** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. Mathis Plapp, Russia receiving Memento from **Prof. P. Ramasamy** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Prof. F.J. Derbey, Journal of Crystal Growth receiving Memento from **Prof. S. C. Gadkari** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University during 28-30 January 2019

Prof. P. P. Ramasamy receiving Memento in the NCAMSES-2019 organized by **Prof. G. Ravi** held at Department of Physics, Alagappa University, Karaikudi during 20-22 March 2019

Prof. Koichi Kakimoto, Japan receiving Memento from **Prof. S. Salivahanan** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Dr. M. Selvapandiyan receiving Memento in the NCETMS-2019 held at Department of Physics, Government Arts College, Tiruvannamalai during 26-27 September 2019

Prof. G. Ravi in the inaugural function of NCAMSES-2019 organized by held at Department of Physics, Alagappa University, Karaikudi during 20-22 March 2019

Prof. D. Arivuoli receiving Memento from **Dr. Muthu Senthil Pandian** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. S. Gunasekaran giving Memento to **Prof. P. Ramasamy** in the ICRAMS-2019 held at Department of Physics, National College during 4-6 February 2019

Prof. Daniel Vizman, Romania receiving Memento from **Prof. R. Jayavel** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Prof. Koichi Kakimoto, Japan receiving Memento from **Prof. R. Jayavel** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Dr. K. Ramachandra Rao receiving Memento from **Prof. Narayana Kalkura** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. R. Arun Kumar receiving Memento with his Ph.D. students from **Prof. P. Ramasamy** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. D. Arivuoli receiving Memento from **Dr. K.V. Ramanujachary** in the ICRAMS-2019 held at Department of Physics, National College, Tiruchirappalli during 4-6 February 2019

Dr. Kulick, Russia receiving Memento from **Prof. Rita John** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Dr. S. A. Martin Britto Dhas receiving Memento from **Prof. S. Balakumar** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. N. Vijayan, CSIR-NPL inaugurated ICAMS-2019 held at Department of Physics, Thanthai Hans Roever College, Tiruchirappalli during 13-14 August 2019

Prof. Jyh-Chen Chen, Taiwan receiving Memento from **Prof. P. Ramasamy** in the MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

Prof. G. Bhagavanarayana receiving Memento from **Prof. R. N. Rai** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. S. C. Gadkari receiving Memento from **Prof. G. Bhagavannaraya** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. P. Ramasamy receiving Memento from **Prof. K. Srinivasan** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Prof. S. Moorthy Babu and **Prof. K. K. Bamzai** evaluating the Crystal Display Presentations in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University during 28-30 January 2019

Dr. Mylswamy Annadurai with **Prof. P. Ramasamy** and **Prof. R. Jayavel** in the inaugural function of ICRTAST-2019 held at SSN Research Centre, SSN Institutions, Chennai during 19-21 September 2019

Prof. Koichi Kakimoto with **Prof. P. Ramasamy** and **Dr. M. Srinivasan** in the inaugural function of MCGPD-2019 held at SSN Research Centre, SSN Institutions, Chennai during 26-28 February 2019

INDIAN ASSOCIATION FOR CRYSTAL GROWTH

Centre for Crystal Growth and SSN Research Centre
SSN Institutions, Kalavakkam, Chennai-603110, Tamilnadu, INDIA
Mobile: +91-9283105760; +91-9944294169 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. Bhagavannarayana. G**, Dean, VSM Group of Institutions, Andhra Pradesh (A.P.)
- **Dr. Binay Kumar**, Professor, Crystal Growth Lab, University of Delhi, New Delhi
- **Dr. Byrappa. K**, Vice-Chancellor, Mangalore University, Karnataka
- **Dr. Das. S.K**, Crystal Growth Section, Department of Physics, KIIT University, Odisha
- **Dr. Ganesamoorthy. S**, Scientific Officer-G, X-Ray and Crystal Growth Section, IGCAR
- **Dr. Gadkari. S.C**, Chief Scientist & Head, Crystal Technology Section, BARC, Mumbai
- **Dr. Jayavel. R**, Professor, Crystal Growth Centre, Anna University, Chennai
- **Dr. Karnal. A.K**, Scientific Officer-G & Head, LFMD, Crystal Growth Section, RRCAT, Indore
- **Dr. Kalainathan. S**, Director, Centre for Crystal Growth, VIT University, Vellore
- **Dr. Mihir. J. Joshi**, Professor & Head, Department of Physics, Saurashtra University, Gujarat
- **Dr. Natarajan. V**, Director, DRDO Research & Innovation Centre, IIT Research Park, Chennai
- **Dr. Suja Elizabeth**, Principal Research Scientist, Crystal Growth Lab, IISc, Bangalore
- **Dr. Sunil Verma**, Scientific Officer-G, Crystal Growth Section, LFMD, RRCAT, Indore, M.P.
- **Dr. Sankaranarayanan. K**, Dean (Science), Alagappa University, Karaikudi
- **Dr. Thamizhavel. A**, Principal Scientist, Crystal Growth Laboratory, TIFR, Mumbai
- **Dr. Vijayan. N**, Principal Scientist, Crystal Growth Section, CSIR-NPL, New Delhi

HONORS / AWARDS

Prof. K. Srinivasan, Bharathiar University receiving **IACG – Prof. P. Ramasamy National Award for Crystal Growth-2019** in the XXIII NSCGA-2019 held at Bharathiar University during 28-30 January 2019. The award carries a Certificate, a Shield and Rs.10,000/= Cash Prize

Dr. Muthu Senthil Pandian, SSN Institutions receiving **IACG - Prof. P. Ramasamy National Award for Crystal Growth-2019** in the XXIII NSCGA-2019 held at Bharathiar University during 28-30 January 2019. The award carries a Certificate, a Shield and Rs.10,000/= Cash Prize

Dr. R. Ramesh Babu receiving Memento from **Prof. Narayana Kalkura** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University during 28-30 January 2019

Dr. P. Murugakoothan receiving ISTA-Elavenil – Best Research Contribution Award-2019 from **Prof. P. Ramasamy** in the MCGPD-2019 held at SSN Institutions during 26-28 February 2019

Dr. K. Sethuraman receiving Memento from **Prof. S. Balakumar** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

Dr. G. Vinitha receiving Memento from **Prof. Binay Kumar** in the XXIII NSCGA-2019 held at Department of Physics, Bharathiar University, Coimbatore during 28-30 January 2019

The release of Abstract CD in the XXIII National Seminar on Crystal Growth and Applications (XXIII NSCGA-2019) held at Department of Physics, Bharathiar University, Coimbatore, Tamil Nadu during 28-30 January 2019

The release of Abstract Book in the 3rd International Conference on Recent Trends in Applied Science and Technology (ICRTAST-2019) held at SSN Research Centre, SSN Institutions, Chennai, Tamil Nadu during 19-21 September 2019

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

9 789395 423168