Dr. K. A. Irshad
Scientist (IISc/ICTP)
High pressure diffraction beamline: Xpress
Elettra Sincrotrone Trieste S.C.p.A.
S.S. 14 Km 163,5 in Area Science Park 34149 Basovizza, Trieste, Italy

Personal Details

Date of Birth : 25th June, 1989
Sex : Male
Marital status : Married
Nationality : Indian
Languages : English, Hindi, Malayalam, Tamil
Address for communication : High pressure diffraction beamline: Xpress
Elettra Sincrotrone Trieste S.C.p.A, S.S. 14 Km 163,5
in Area Science Park 34149 Basovizza, Trieste, Italy
Email : irshad.kariyattuparamb@elettra.eu; irshadka17@gmail.com
Phone : 040-375-8807 (office) ; +39-3882527689 (Mob)

Education

2019 **Ph.D, Physical sciences**
Homi Bhabha National Institute, Mumbai, India.
July 2013-August 2018

2012 **M. Sc, Physics (CGPA -7.79)**
Central University of Kerala, Kasaragod, Kerala, India
Jul 2010 – Sep 2012

2010 **B. Sc, Physics (75.1 %)**
University of Calicut, Calicut, Kerala, India
Jun 2007 – Mar 2010

2006 **Intermediate (81.33 %)**
Puliyaparamb Higher Secondary School, Kodunthirapully, Palakkad, Kerala
May 2005 – Mar 2007

Academic Positions

2021- Beamline Scientist, Elettra Sinchrotron Trieste, Italy

2018-2021 Post Doctoral Research Associate, IGCAR Kalpakkam

2015-2018 Senior research fellow, IGCAR Kalpakkam

2013-2015 Junior research fellow, IGCAR Kalpakkam

2012-2013 Higher secondray school teacher, Puliya Parambu HSS,Palakkad, Kerala, India

Research Interests

1. Structural properties of materials at extreme conditions of pressure and temperature.
2. *In-situ* high pressure - high temperature studies on rare earth sesquioxides.
3. Investigating the structure property correlations in rare earth and actinide compounds.
4. High pressure synthesis of potential super hard materials.
5. Development of novel experimental techniques for DAC based studies.

Research Experience

Beamlinet Scientist (Sept 2021-present) Carrying out high presure high/low temperature X-ray diffraction studies on various materials, developing novel experimental techniques for DAC based studies. I have been the local contact for supportig users around the world for synchrotron experiments. In addition, my responsibilities includes preparing and documenting the montly and yearly reports of the beamline, technical evaluation of the proposal and periodic maintanance of the facilities available at the beamline.

Research Associate (Sept 2018-Sept 2021) Investigating the high pressure-high temperature behaviour of radio active nuclii loaded zeolites for applications related to the nuclear waste immobilization. I was also involved in exploring structure property correlations in metastable phase of HfO_2 at highpressure and high temperatures.

Senior/Junior Research Fellow (Jul 2013–Aug 2018) During this period I have carried out research work on my doctoral thesis under the title "Study of crystal structure of functional rare earth sesquioxides at high pressures". I aquired the skills to operate the diamond anvil cell which a tool par excellence for generating megabar pressures in the laboratory. I was assigned to look in to the phase transition behaviour of rare earth sesquioxides. To accomplish my goals, I had been introduced to laboratory and synchrotron based X-ray diffraction, Raman spectroscopy and scanning electron microscopy experimental techniques and their analysis methods. I was also handling the programmes GSAS, LHPM-Rietica, CMPR, Fit2D, WIRE, Image J, PCW 2.3, VESTA etc., for analysing the data.

M. Sc Dissertation (June 2010–July 2012) During this period, I have completed my master's degree in physics. As part of the M. Sc dissertation, six month project work titled "Study of fission fragment mass distribution for ^{30} Si+^{180} Hf reactions at energies 128 MeV, 137 MeV And 144 MeV" was carried out. In collaboration with the Inter University Accelerator Centre, New Delhi, India, I have studied the fusion fission reaction kinetics and the fission fragment mass distributions when these nuclei collide to form a super heavy nucleus.

Scientific Skills

1. Expertise in handling Mao-Bell type, Symmetric and Gas Membrane Driven diamond anvil cells (DAC) for the generation of high pressures.
2. Hands on experience in *insitu* low temperature high pressure diffraction system
3. Expertise in *insitu* high temperature high pressure diffraction measurements.
4. Proficiency in Gas loading system for High pressure experiments.
5. Proficiency in synchrotron based high pressure X-ray diffraction experiments

6. Beamline management and user assistance
7. Rietveld structure refinement of X-ray diffraction data
8. Material characterization using powder X-ray diffraction, Raman spectroscopy and Scanning Electron Microscopic (SEM) techniques
9. Developed a novel X-ray slit for Mao-Bell type DAC, useful in laboratory based high pressure X-ray diffraction experiments.
10. **Packages** : *GSAS, LHPM Rietica, CMPR, Fit2D, EOSfit, Image J, PCW 2.3, VESTA, etc.,*

Research Publications

Publications in the peer-reviewed international journals:

1. Structural Stability and Phase Transitions in Zeolite A: An In Situ High Pressure–High Temperature Investigation. **K. A. Irshad***, N. R. Sanjay Kumar, M. Mahima Kumar, and Hrudananda Jena, **Inorg. Chem**. 61(35), 13792–13801(2022).
doi: https://doi.org/10.1021/acs.inorgchem.2c01626

2. Removal of Cs^{+} and Sr^{2+} ions from simulated radioactive waste solutions using Zeolite-A synthesized from kaolin and their structural stability at high pressures. M.Mahima Kumar, **K. A. Irshad** and Hrudananda Jena, **Microporous and Mesoporous Materials** 312, 110773 (2021).
doi: https://doi.org/10.1016/j.micromeso.2020.110773

3. Structural phase transition, equation of state and phase diagram of functional rare earth sesquioxideceramics $(Eu_{1-x}La_x)_2O_3$. **K. A. Irshad***, V. Srihari, S. Kalavathi and N. V Chandra Shekar, **Sci Rep**10,11829 (2020).
doi: https://doi.org/10.1038/s41598-020-68400-9

4. High pressure structural stability, equation of state and thermal expansion behaviour of cubic HfO_2. **K. A. Irshad***, Velaga Srihari, D. Sanjay Kumar, K. Ananthasivan and Hrudananda Jena, **Journal of American Ceramic Society** 103, 5374– 5381 (2020).
doi: https://doi.org/10.1111/jace.17266

5. Anomalous Lattice Compression in the Hexagonal La_2O_3 – A high pressure X-ray diffraction, Raman spectroscopy and First principle study. **K. A. Irshad***, P. Anees, R. Rajitha, T. R. Ravindran, V. Srihari, S. Kalavathi and N. V. Chandra Shekar, **Journal of Alloys and Compounds** 822, 153657 (2020).
doi: https://doi.org/10.1016/j.jallcom.2020.153657

6. Micro strain assisted polymorphic phase transitions in $(Eu_{1-x}La_x)_2O_3$. **K. A. Irshad**, A. Saikumaran, V. Srihari, S. Kalavathi and N. V Chandra Shekar, **Journal of Applied Crystallography** 52, 32-39 (2019).
doi: https://doi.org/10.1107/S1600576718016989

7. Pressure induced structural phase transition in rare earth sesquioxide Tm_2O_3 : Experiment and *ab initio* calculations. **K. A. Irshad**, P. Anees, S. Sahoo, N. R. Sanjay Kumar, V. Srihari, S. Kalavathi and N. V. Chandra Shekar, **Journal of Applied Physics** 124 (15), 155901 (2018).
doi: https://doi.org/10.1063/1.5049223

8. High pressure studies on Thorium-Praseodymium mixed oxides. **K. A. Irshad**, D. Sanjay Kumar, G. Paneerselvam, K. Ananthasivan, N. V. Chandra Shekar and S. Kalavathi, **Journal of Nuclear Materials** 498 (Supplement C), 221-226 (2018).
doi: https://doi.org/10.1016/j.jnucmat.2017.10.029

9. A novel and simple X-ray slit for diamond anvil cell based X-ray diffraction experiments. **K. A. Irshad**, N. R. S. Kumar and N. V. C. Shekar, **Measurement Science and Technology** 28 (4), 047002 (2017).
doi: https://doi.org/10.1088/1361-6501/aa5e25

10. High pressure structural phase transitions in Ho: Eu_2O_3. **K. A. Irshad**, N. V. Chandra Shekar, V. Srihari, K. K. Pandey and S. Kalavathi, **Journal of Alloys and Compounds** 725, 911-915 (2017).
doi: http://dx.doi.org/10.1016/j.jallcom.2017.07.224

11. Anomalous lattice compressibility of hexagonal Eu_2O_3.**K. A. Irshad** and N. V. Chandra Shekar, **Materials Chemistry and Physics** 195, 88-93 (2017). doi: http://doi.org/10.1016/j.matchemphys.2017.04.012

12. X-ray diffraction and Raman studies on Ho: Eu_2O_3. **K. A. Irshad**, N. V. Chandra Shekar, T. R. Ravindran, V. Srihari and K. K. Pandey, **Journal of Molecular Structure** 1128, 325-329 (2017). doi: http://dx.doi.org/10.1016/j.molstruc.2016.08.077

Appearance in national/ international conferences:

1. High-Pressure High-Temperature Structural Stability of Zeolite-A, **K. A. Irshad**, N. R Sanjay Kumar, M. Mahima Kumar and Hrudananda Jena, 8^{th} Interdisciplinary Symposium on Materials Chemistry (ISMC-2020), June 17-19 2021, Bhabha Atomic Research Centre, Mumbai, India

2. High Pressure Structural Stability and Equation of State of Cubic HfO_2, **Irshad .K. A**, Hrudananda Jena, Sanjay Kumar. D, Ananthasivan. K, Panigrahi. B. K, **64^{th} DAE Solid State Physics Symposium**, Indian Institute of Technology, Jodhpur, Rajasthan, India, 2019

3. Polymorphism in rare earth sesquioxides: dependence on pressure and cationic radii. **K. A. Irshad**, N. V. Chandra Shekar and S. Kalavathi, **24^{th} Congress and General Assembly of the International Union of Crystallography**, Hyderabad, India.

4. High pressure structural phase transition in Tm_2O_3. **K. A. Irshad**, N. V. Chandra Shekar and S. Kalavathi, **2 nd International Conference on Condensed Matter and Applied Physics** (2017), Bikaner Rajasthan, India

5. High Pressure Studies on Thorium-Praseodymium Mixed Oxides. **K. A. Irshad**, N. V. Chandra Shekar, G. Paneerselvam, D. S. Kumar and K. Ananthasivan, **61^{st} DAE Solid State Physics Symposium**, KIIT University, Bhubaneswar, India, 2017.

6. Investigation of pressure-concentration (P-x) phase diagram for rare earth mixed oxide ceramic system : $(Eu_{1-x}Ho_x)_2O_3$. **K. A. Irshad** and N. V. Chandrashekar, **MRSI, 27^{th} AGM, 18-20 Feb. 2016**, CSIR North East Institute of Science and Technology, Jorhat, India, p.46

Conference publications:

1. Theoretical and experimental investigation of different phases in as cast equiatomic CrFeMoNbV alloys. A. Saikumaran, R. Mythili, S. Saroja, **K. A. Irshad**, S. Kalavathy, and Rajesh Ganesan, **AIP Conference Proceedings** 2115, 030018 (2019). doi: https://doi.org/10.1063/1.5112857

2. Polymorphism in rare earth sesquioxides: dependence on pressure and cationic radii. **K. A. Irshad**, N. V. Chandra Shekar and S. Kalavathi**, Acta Crystallographica Section A** 73 (a2), C1256 (2017). doi: http://dx.doi.org/10.1107/S2053273317083188

Citation Metrics

Total Number of Citations	:	112
h-index	:	7
i10-index	:	6

Invited Talks

1. High pressure- High temperature structural studies on Zeolite-A, International Conference on Recent Advances in High Pressure Science and Technology(ICReAcH-2022), 8-10, February 2022, Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamil Nadu(WebEx Online Platform), India

2. *Diffraction In Crystals*, TEQIP-III Sponsored Five-Day Online Faculty Development Programme on "FRONTIERS IN PHYSICS RESEARCH" From 10^{th} To 14^{th} August 2020, Organised by the Department of Physics, Government College of Engineering, Bargur, Krishnagiri, Tamilnadu, India.

3. *Rietveld Method: A Brief Introduction to Crystal Structure Refinement Using GSAS Programme*, TEQIP-III Sponsored Five-Day Online Faculty Development Programme on "FRONTIERS IN PHYSICS RESEARCH" From 10th To 14th August 2020, Organised by the Department of Physics, Government College of Engineering, Bargur, Krishnagiri, Tamilnadu, India.

Fellowships and Awards

Awards:

1. **Homi Bhabha medal for the best thesis** in physical sciences, 2019, IGCAR, Kalpakkam

Fellowships:

1. Senior Research Fellowship, Department of Atomic Energy, India, (2015)
2. Junior Research Fellowship, Department of Atomic Energy, India, (2013)

Reference

1. Dr. N. V. Chandra Shekar
   Professor, Homi Bhabha National Institute (HBNI);
   Associate Director, Materials Science Group
   Indira Gandhi Centre for Atomic Research, Kalpakkam, Tamilnadu, India - 603102
   email : chandru@igcar.gov.in, nvcshekar@gmail.com
   Phone: +91-44-27480015 (Office), Mobile: +91 9488361131
2. Dr. Boby Joseph
   Scientist and coordinator
   Xpress - High pressure diffraction beamline,
   Elettra-Sincrotrone Trieste, Strada Statale 14 - Km 163,5 in AREA Science Park,
   34149 Basovizza, Trieste ITALY
   email: boby.joseph@elettra.eu
   Phone: +39 0403758737 (office ES4 P1 031), Mobile: +39 3666907300
   +39 0403758434 (Lab: beamline)
3. Dr. Krishan Kumar Pandey
   Scientific Officer (F)
   Beamline Scientist (Indus II Synchrotron Facility)
   High Pressure and Synchrotron Radiation Physics Division
   Bhabha Atomic Research Centre, Mumbai-400085
   email: kkpandey@barc.gov.in, pandey.krishan@gmail.com
   Phone: +91-22-25592753 (Office)