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# The Fourth State

Newsletter of the Institute For Plasma Research, Gandhinagar, Gujarat (India)



## Workshop on Intellectual Property Rights

IPR has been developing technologies for fusion as well as for societal benefits. To secure such knowledge, IPR has been actively securing the Intellectual Property by way of patents, designs, copyrights and trademarks. Considering the utilization of knowledge for present and future, World Intellectual Property Organization (WIPO) had emphasized on Youth by celebrating 26th April 2022 on the theme "*IP and Youth: Innovating for a better future*". IPR had also been planning to organize a workshop on IP awareness amongst its employees, especially young researchers.

Considering the need and with the support of DAE patent cell, IPR had organized a one day workshop on Intellectual Property Rights on 12-May-2022 at IPR, Bhat, Gandhinagar. The programme was attended by over 60 participants from the Institute. Dr. Paritosh Chaudhury, chairman-TTIP committee welcomed the guests and Dr. Shashank Chaturvedi, Director-IPR delivered the welcome note. The talks by speakers included talks on introduction to IP, Patenting, Journey of patent to technology by Mrs. Anuradha Maheshwari, Founder - LexMantis, on Tech transfer by Dr. Nirav Jamnapara and on DAE experience with patenting by Shri P R Dani, Member Secretary - DAE IPR Cell.

The event was ended with vote of thanks by Mr. Saroj Das, Member Secretary - TTIP committee. During the workshop, it was suggested that such workshops should be conducted every year, which the TTIP committee noted for further consideration.



View of the participants of the Workshop on Intellectual Property Rights



(L-R) Dr. Nirav Jamnapara, Dr. Paritosh Chaudhury, Dr. Shashank Chaturvedi, Shri P R Dani, and Mrs. Anuradha Maheshwari addressing the gathering.





Images from the event.



(L) Shri P R Dani (DAE IPR Cell) and (R ) Mrs. Anuradha Maheshwari (M/s LexMantis) being felicitated during the event.



प्रधान कार्यालय, बैंक ऑफ़ बड़ौदा गांधीनगर के तत्वाधान में दिनांक 06.04.2022 को वेबिनार के माध्यम से नगर राजभाषा कार्यान्वयन समिति, गांधीनगर की 18वीं बैठक का आयोजन हुआ, जिसमें आईपीआर तथा गांधीनगर के नगर राजभाषा समिति के विभिन्न कार्यालयों के प्रमुख, राजभाषा प्रभारी एवं प्रतिनिधियों ने भाग लिया। बैठक के प्रारंभ में श्री दीपांकर गुहा, अध्यक्ष, नराकास, गांधीनगर ने अभिभाषण दिया। उसके पश्चात् सदस्य-सचिव, नराकास, गांधीनगर द्वारा सदस्य कार्यालयों की छमाही रिपोर्ट की समीक्षा की गई। श्री संजय सिंह, प्रमुख, राजभाषा विभाग, बैंक ऑफ़ बड़ौदा गांधीनगर ने रिपोर्ट में पाई गई कमियों को दूर करने हेतु सुझाव दिए हैं साथ ही राजभाषा के अधिक प्रयोग हेतु भाषा सम्मान पुरस्कार की शुरुआत करने का सुझाव दिया। बैठक के दौरान काफी समय से लंबित नराकास की छ माहि पत्रिका 'गांधीनगरी' के प्रकाशन के बारे में विस्तृत चर्चा की गयी तथा इस दिशा में प्रकाशन हेतु सभी कार्यालयों को आवश्यक कदम उठाने को कहा गया। साथ ही राजभाषा वार्षिक कार्यक्रम 2022-23 के बारे में चर्चा हुई। बैठक के दौरान अध्यक्ष महोदय द्वारा वर्ष 2021 के लिए वार्षिक राजभाषा शील्ड पुरस्कार की घोषणा की गयी। **वर्ष 2021 के लिए यूनियन बैंक ऑफ़ इण्डिया को प्रथम पुरस्कार, प्लाज़्मा अनुसंधान संस्थान को द्वितीय पुरस्कार एवं होटल प्रबंधन संस्थान को तृतीय पुरस्कार प्राप्त हुआ है।**

इस बैठक में राजभाषा के कार्यान्वयन के लिए अति महत्वपूर्ण तिमाही प्रगति रिपोर्ट, राजभाषा कार्यान्वयन समिति की बैठक, हिंदी कार्यशाला तथा कार्यालय में अनुभागों के निरीक्षण संबंधी बहुमूल्य जानकारी साझा की। नगर राजभाषा कार्यान्वयन समिति की यह बैठक आईपीआर तथा नगर राजभाषा समिति के सदस्यों के लिए काफी महत्वपूर्ण रही।

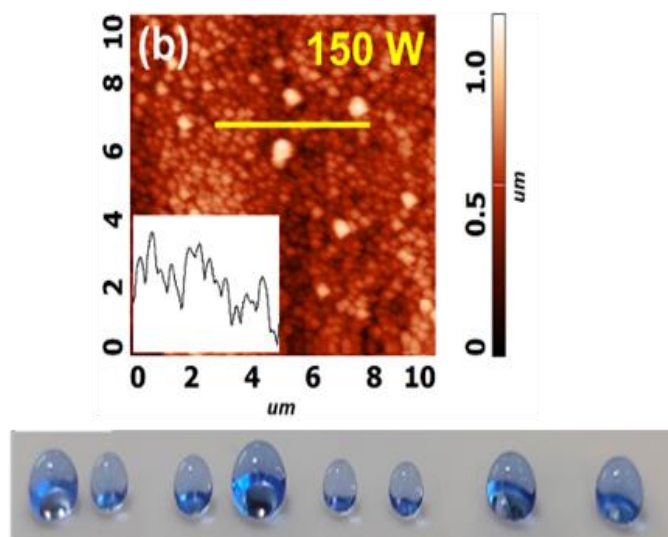
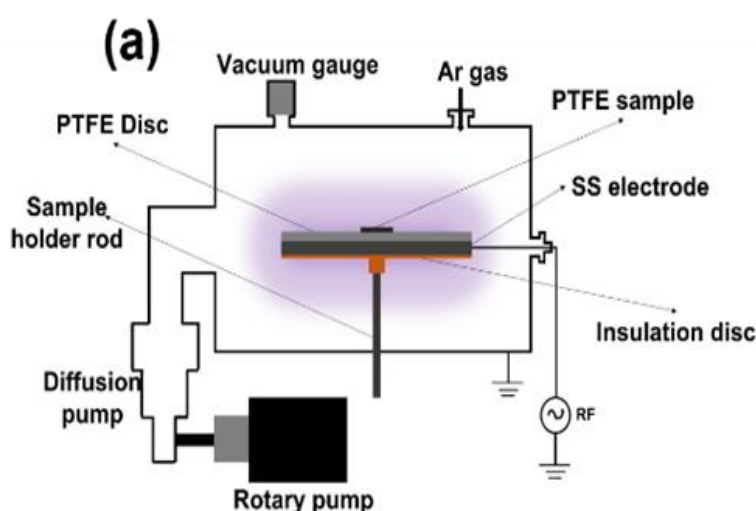
बैठक का समापन आईपीआर के निदेशक, शशांक चतुर्वेदीजी द्वारा धन्यवाद ज्ञापन के साथ हुआ।



## Large Area Nanostructured Super-Hydrophobic Teflon Surface Using RF Ar Plasma

Surface modification using plasma processing is a well-known technique to achieve functional surface properties such as hydrophobicity or hydrophilicity, surface activation, surface hardening, surface bonding and adhesion etc. In particular, the wetting properties of plasma etched polytetrafluoroethylene (PTFE) polymer surfaces is extensively studied over the last few years due to their variety of industrial applications.

Production of super-hydrophobic PTFE using Ar plasma alone is found to be challenging as this leads to various bond scission of the polymer surface. Since PTFE is a soft polymer, it is necessary to treat the surface using very low ion energy and dose. Hence, a systematic study of Ar plasma treatment on PTFE surfaces has been carried out to produce large-area super-hydrophobic PTFE surfaces using RF Ar plasma etching. After treating the surface with RF plasma regular nanostructures are formed on the surface as shown in Figure 1(b). The surface became super-hydrophobic with a contact angle of  $156^\circ$ . Even after 180 days testing surface retained its contact angle. The study was conducted by the Plasma Surface Engineering Group (PSED) of IPR.



(a) Schematic diagram of the high vacuum system used for plasma etching of PTFE, (b) AFM images of plasma treated PTFE and demonstration of superhydrophobicity.

As part of the AKAM celebrations, IPR plans to conduct several scientific outreach activities in rural Gujarat. In view of this, IPR, in collaboration with the Gujarat Council on Science and Technology (GUJCOST) conducted a training programme for science communicators of the various Regional Community Science Centers of Gujarat State. Thirty four science communicators from CSC's and other educational institutions in Gujarat (28 male and 6 female communicators) attended this two-day programme that was held at IPR during 12-13 May, 2022.

This programme envisages to train the science communicators in plasma & its applications so that IPR can hold scientific outreach activities in more rural areas of the state with the help of Regional Science Centers. The programme had popular lectures and hands-on experiments as well as extended Q&A sessions that were held in the Outreach Hall at IPR. The participants also visited several laboratories in IPR and FCIPT and were provided resource materials to help them propagate the science of plasma through their centers. Certificates were also provided to all the participants.

The programme was inaugurated by Dr. Shashank Chaturvedi, Director, IPR and Dr. Narottam Sahoo, Advisor, GUJCOST. During his address Dr. Chaturvedi urged the participants to highlight the various applications of plasma when they conduct programs at their regional centers. More details are available [here](#).



Dr. Shashank Chaturvedi and Dr. Narottam Sahoo lighting the lamp during inauguration of the training programme.



(L) Dr. Narottam Sahoo and (R) Dr. Shashank Chaturvedi addressing the participants of the programme



(L) Inauguration of the event (R) Dr. Sahoo viewing the exhibits.







Campus visits to IPR/FCIPT in the month of June, 2022

Date	Name of the Institution	Number of visitors
10-Jun-2022	National Forensic Science University, Gandhinagar	46 students of B.Sc and M.Sc integrated course and 2 faculty members
29-Jun-2022	Mahatma Gandhi International School, Ahmedabad	55 students of 11-12 std and 3 faculty members



Students and faculty members of the National Forensic Science University during their visit to IPR



Students and faculty members of the Mahatma Gandhi International School, Ahmedabad, during their visit to IPR



As part of the AKAM celebrations, IPR has been conducting a series of scientific outreach activities in rural schools of different districts of Gujarat. The third such event was conducted during 20-24 June, 2022 at the **Akshargyan Vidya Mandir, Thara, Kakrej Taluka, Banaskantha (Dt)**. This is a Gujarati medium school with over 650 students studying in classes 1-12.

The 4-day event consisted of popular talks on plasma and its applications and exhibition of over 15 working models. Over 450 students and teachers from this school as well as around 700 students from nearby schools and colleges in this taluka and general public visited the exhibition.

A highlight of this programme was that around 20 students of 10th standard were trained to explain the exhibits to the visitors. As part of the event, the Gujarati version of the children's comic book on plasma "*The Wonderful World of Plasma*" was also distributed to all the visiting students and teachers. A set of 10 posters on plasma and a popular book on plasma "*Living with Plasma*" were also distributed to the visiting schools for display in their school's library. IPR Outreach proposes to conduct such events in rural schools of Amreli and Bhuj districts of Gujarat in the coming months. [Click here for details.](#)



Click on images to see 360 degree photos of the event



Popular lecture on plasma





Images from the rural outreach programme at Thara, Banaskantha



The General Body Meeting (GBM) of IPR Staff Club was organized on Thursday 26 May 2022. Dr. Amulya Sanyasi, the designated Election Officer for Staff Club Election, announced the names of the elected members. The president of outgoing committee, Ms. Chhaya Chavda presented balance sheet and account of activities carried out during 2020-21. The following IPR staff members took over as the Staff Club Committee members for the term 2022-23.



**Ritesh Sugandhi**  
President



**Harish C. Khanduri**  
General Secretary



**Karishma Qureshi**  
Cultural Secretary



**Vijay Vasava**  
Sports Secretary



**Hitesh Suthar**  
Treasurer



**Aditya Panchasara**  
Joint Treasurer



**Suvitha Kartha**  
Joint Cultural Secretary



**Karishma Pandya**  
Joint Cultural Secretary



**Chetan Jariwala**  
Joint Cultural Secretary



**Ram Krushna Mohanta**  
Joint Sports Secretary



**Deepak Mandge**  
Joint Sports Secretary



**Shubhadip Das**  
Joint Sports Secretary



The SST-1 Cryogenic Division have been carrying out in-house development of Bi-Metallic joint of dissimilar material of Aluminium and Stainless steel has been initiated. This could be an alternative selection of commercially available explosive, friction and splash welded joints. In cryogenic division,  $\frac{3}{4}$ " and 1" NB sizes of Bi-metallic joint has been fabricated by crucial technique of bonding with cryogenic grade epoxy resin system. The developed joints have been undergone rigorous testing at liquid nitrogen temperature. The test results of joints found in acceptable limit at 300 K and 77 K. The developed joints can overcome the issues of distortion, high temperature, wear and tear on contacting surfaces and reduction the life of machine parts and high cost factor. This type of Bi-metallic joints can be used for heat exchanger, cryogenic services etc. The batch wise fabrication and mechanical testing is under progress for repeatability of acceptance and reliability of the product. The custom design of Bi-Metallic joints can be made as per the system requirement.

## Salient Features:

- ✦ Bi-Metallic joint type: In-house developed cryogenic epoxy resin based
- ✦ Materials grade: SS 304 L + Al 6082/HE30
- ✦ Temperature range: 300 -77 -4.2 K
- ✦ Fabricated size :  $\frac{3}{4}$ " and 1" NB
- ✦ Helium leak tightness (i) at 300 K :  $3.7 \times E-09$  mbar l/s (ii) after thermal shock at 77 K in dipped condition :  $1.3 \times E-09$  mbar l/s (iii) In LN<sub>2</sub> dipped condition at 10 bar (g) helium pressure inside :  $1.0 \times E-08$  mbar l/s (sniffer zero mode)



(L-R) Developed Bi-Metallic Joints ; He leak test at 300 K  $3.7 \times 10^{-09}$  mbar l/s ; Thermal shock test (dipped) at 77 K; Helium leak test (sniffer) @ 10 bar (g), 77 K

## हिंदी कार्यशाला

आईपीआर की राजभाषा कार्यान्वयन समिति द्वारा संस्थान के प्रवीणता प्राप्त स्टाफ सदस्यों के लिए दिनांक 10.06.2022 को ऑनलाइन हिंदी कार्यशाला का आयोजन किया गया। कार्यशाला का संचालन डॉ. संध्या दावे, हिंदी अधिकारी, प्लाज्मा अनुसंधान संस्थान द्वारा किया गया। इस कार्यशाला का मुख्य उद्देश्य प्रवीणता प्राप्त कर्मचारियों को कंप्यूटर पर हिंदी में आसानी से कार्य करने हेतु प्रशिक्षित करना तथा हिंदी में कार्य करने हेतु उपयोगी कम्प्यूटर टूल्स की जानकारी देना था। डॉ. संध्या दावे ने बताया कि यह संस्थान मुख्य रूप से अनुसंधान एवं तकनीकी कार्यों में संलग्न है इस लिए हिंदी में कार्य करने में थोड़ी कठिनाई जरूर होती है, लेकिन वर्तमान समय में अद्यतन तकनीक एवं सॉफ्टवेयर का उपयोग करके आसानी से हिंदी में कार्य किया जा सकता है।

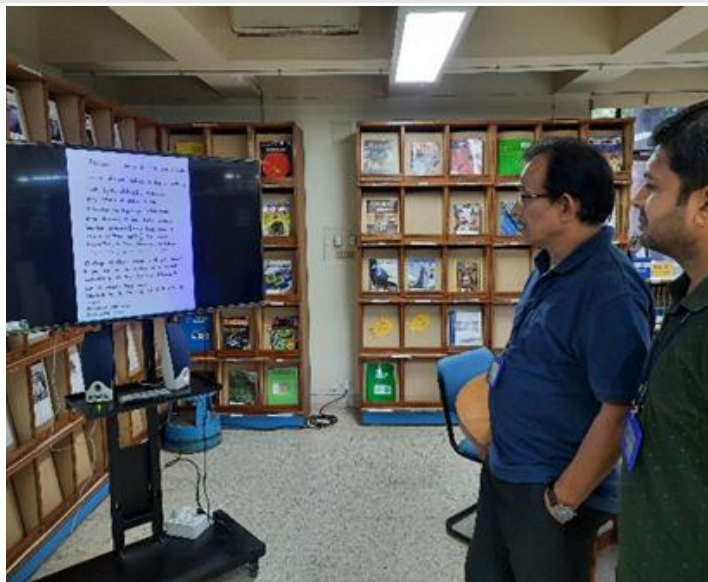
कार्यशाला के दौरान हिंदी फॉन्ट को इनस्टॉल करके कैसे एक्टिवेट किया जाता है इस विषय पर विस्तृत चर्चा की गई। इसके बाद अनुवाद टूल्स के बारे में विस्तृत जानकारी प्रतिभागियों को दी गई। साथ ही मशीनी अनुवाद के फायदे और नुकसान के बारे में बताते हुए सावधानीपूर्वक शब्दों का चयन करने का सुझाव दिया गया। इसके अलावा, गूगल द्वारा जारी वॉईस टायपिंग टूल्स से सब प्रतिभागियों को अवगत कराया गया और बताया गया कि इसके उपयोग से कैसे टंकण कार्य को कम करके समय बचाया जा सकता है। हिंदी अधिकारी द्वारा अनुवाद संबंधी विविध वाक्यों और शब्दों के मशीनी अनुवाद तथा इसके तकनीकी अनुवाद के पहलुओं पर प्रकाश डालते हुए, त्रुटिपूर्ण अनुवाद से कैसे बचा जा सकता है, इस पर विस्तृत चर्चा की गई।



प्रतिभागियों को संस्थान में लागू परमाणु ऊर्जा विभाग की अटॉलिस हिंदी प्रोत्साहन योजना के बारे में बताया गया और वैज्ञानिक एवं तकनीकी अधिकारियों/कर्मचारियों को इस योजना में भाग लेने हेतु उत्साहित किया। इसके बाद, आईपीआर वेबसाइट पर अध्ययन किए गए राजभाषा पोर्टल से सबको अवगत कराया गया। इस कार्यशाला में कुल 28 अधिकारियों/कर्मचारियों ने भाग लिया। हिंदी के प्रयोग को बढ़ावा देने हेतु यह कार्यशाला बहुत महत्वपूर्ण रही और कार्यशाला के माध्यम से हिंदी के नवीनतम उपयोगी तकनीकी सॉफ्टवेयर से सभी प्रतिभागियों को परिचित किया गया।

कार्यशाला में ऑनलाइन माध्यम से जुड़े प्रतिभागियों की छवियाँ





IPR Library arranged a floral tribute to Prof P. K. Kaw on his 5<sup>th</sup> death anniversary on 17 June 2022. A poster showing a glimpse of his life and work was displayed. A short video compilation of his handwritten works was also displayed in the library.

## Congratulations !

Dr. Arunsinh B. Zala who completed his PhD studies from HBNI - IPR was conferred upon with the J B Joshi Innovation Award 2022 by Homi Bhabha National Institute for his doctoral research work "*Investigations on Weldability of Aluminide Coated 9cr Steel*". The award comprised of a citation and a cash prize of Rs. 25,000/-. This award is given to one student each year whose thesis work involves innovation driven approach to address an application. The nominations received are reviewed in a two-step process by a committee and the shortlisted candidates are interviewed through a presentation for final selection. The award was conferred upon to the awardee on HBNI Foundation Day, 3rd June 2022. The award was conferred upon Dr. Zala through the hands of Dr. A. V. Rama Rao, Founder & Managing Director - Avra Laboratories Pvt. Ltd. and Former Director - IICT Hyderabad.

On behalf of IPR, IPR Newsletter congratulates Dr. Zala on this achievement !



Dr. Arunsinh B. Zala receiving the J B Joshi Innovation Award 2022 from Dr. A. V. Rama Rao



- ◆ **Dr. Rakesh Moulick**, gave an invited talk on "*Fundamentals of Plasma Theory and Simulation*" at a Workshop on Basic Plasma Physics, Dept. of Physics, Assam Don Bosco University, Assam, on 6th May 2022
- ◆ **Mr. H. L. Swami**, gave a talk on "*Evaluation of Mo-99 and Lu-177 Radioisotopes Production in 14 MeV Neutron Generator Facility*" at DAE-BRNS Two-Day Theme Meeting on Strategic Planning for Enhancing Research Reactor Utilization (RRU-2022), Bhabha Atomic Research Centre, Mumbai, on 6-7th May 2022
- ◆ **Dr. Shwetang N. Pandya**, gave a talk on "*Deposited Layer Substrate (DeLaS) - a module for radiation measurement*" at Topical Conference on High Temperature Plasma Diagnostics, University of Rochester, USA, on 16th May 2022
- ◆ **Ms. Varsha Siju**, gave a talk on "*Investigating the effect of density variation on Pitch angle scattering events of Runaway electrons as observed through ECE Diagnostic at Aditya-Upgrade tokamak*" at High Temperature Plasma Diagnostics (HTPD-22) conference, Rochester University, New York, on 19th May 2022
- ◆ **Prof. Parthasarathi Ghosh**, IIT-Kharagpur, gave a talk on "*Research activities at PED laboratory, Cryogenic Engineering Centre, IIT-Kharagpur*" on 31st May 2022 (**Colloquium #314**)
- ◆ **Dr. Meenakshee Sharma**, gave a talk on "*Exploration of Propagation Window for Ion Acoustic Wave in MPD*" on 31st May 2022
- ◆ **Dr. S R Mohanty**, CPP-IPR, Assam, gave a talk on "*Overview of Inertial Electrostatic Confinement Fusion Research Activities at CPP-IPR*" on 31st May 2022
- ◆ **Dr. Sudheer**, gave a talk on "*Plasma fireball-mediated ion implantation for nonvolatile memory application*" on 01st June 2022
- ◆ **Dr. Arunsinh B. Zala**, gave a talk on "*Development of Aluminide coating on Ni based super-alloys*" on 02nd June 2022
- ◆ **Ms. Swapnali Khamaru**, gave a talk on "*The dynamics of electron plasmas confined in toroidal magnetic fields : An exploration using 3D Particle-in-Cell simulation*" on 3rd June 2022
- ◆ **Dr. Rahul Awathankar**, VFSTR University, Guntur, Andhra Pradesh, gave a talk on "*To design and develop IoT based smart automation system for industry*" on 3rd June 2022
- ◆ **Dr. Pallabi Pathak**, gave a talk on "*The tomographic diagnostic of Helicon Experiment for Negative Hydrogen Ion (HELEN) device*" on 09th June, 2022
- ◆ **Mr. Agraj Abhishek**, gave a talk on "*Deep Learning based human detection using surveillance imaging technologies*" on 14th June 2022
- ◆ **Dr. Arun Kumar**, Anna University, Chennai, gave a talk on "*Surface modification of polymeric materials using glow discharge plasma*" on 17th June, 2022
- ◆ **Mr. Soumen De Karmakar**, gave a talk on "*Collective dynamics of active or self-propelled particles*" on 21st June, 2022

### Upcoming Events

- ◆ FuseNet PhD Event at Orto Botanico, Italy, 4-6 July 2022. <https://indico.fusenet.eu/event/35/>
- ◆ 8th International Youth Conference on Energy, Eger, Hungary, 6-9 July 2022. <http://www.iyce-conf.org/>
- ◆ PlasmaSurf 2022, at University of Lisbon, Portugal, 10-15 July 2022. <https://fusenet.eu/event/plasmasurf-2022>
- ◆ 26th International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, 10-15 July 2022. <https://www.smirt26.com/>
- ◆ 2nd IAEA Workshop on Fusion Enterprises, United Kingdom Atomic Energy Authority, Oxford, 11-13 July 2022. <https://conferences.iaea.org/event/304/>
- ◆ EuroScience Open Forum (ESOF), Leiden, Netherlands, 13-16 July 2022. <https://www.esof.eu/>
- ◆ Culham Plasma Physics Summer School, Abingdon, United Kingdom, 18-28 July 2022. <https://culhamsummerschool.org.uk/>
- ◆ 2nd IAEA Technical Meeting on Plasma Disruptions and their Mitigation, Saint-Paul-lez-Durance, France, 19-22 July 2022. <https://conferences.iaea.org/event/281/>
- ◆ 25th Europhysics Conference on Atomic and Molecular Physics of Ionized Gases, Paris, France, 19-23 July 2022 Paris, France. <https://escampig2022.sciencesconf.org/>
- ◆ Plasma Processing Science- Gordon Research Seminar on "Investigating Multiphase and Multiscale Plasma-Material Interactions" at Andover, US held on 23-24 July 2022. <https://www.grc.org/plasma-processing-science-grs-conference/2022/>
- ◆ Plasma Processing Science- Gordon Research Conference on "Plasmas and Their Interactions with Matter", USA held on 24 - 29 July 2022. <https://www.shorturl.at/hrA11>
- ◆ Nanoscience@Surfaces Summer School 2022 at Liverpool, 25-28 July 2022. <https://www.iop.org/events/nanosciencesurfaces-summer-school-2022>
- ◆ 11th ITER International School: ITER plasma scenarios and control, San Diego, California, USA, 25-29 July 2022. <https://iis2022.burningplasma.org/>



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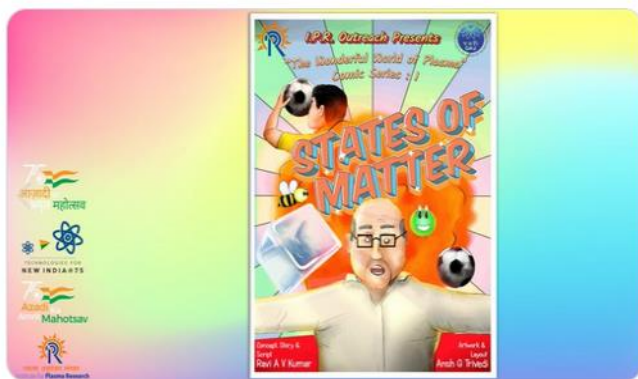
## Know Your Colleague



**Dr. Premjit Singh Kongkham** joined IPR in 2008 as Scientific Officer D and currently serving as Scientific Officer F in High-Temperature Technologies Division (HTTD). He contributed in PFC development of a medium-sized ITER Divertor type dome of high heat flux (HHF) capacity of 5 MW/m<sup>2</sup> which has been successfully tested for 1200 cycles (up to incident heat flux of 6 MW/m<sup>2</sup>). Also contributed in the design and fabrication of reflector plate and tungsten monoblock mock-up by vacuum brazing technique. Fabricated dissimilar materials joints and thermal cyclic testing in Gleeble 3800. He currently handles Laser flash thermal conductivity system, magnetron sputtering system, four-probe resistivity unit and metallography equipment for electrical and thermal properties measurement and metallography of materials/joint samples. He established the CNC abrasive waterjet cutting facility at IPR. He guided TTP, SSP, academic projects for B.Tech and M.Tech students. He recently developed various types of tungsten electrodes for Plasma guns for coating applications.

## DAE Twitter Post on IPR Comic Book on Plasma

**DAE India @DAEIndia · Jun 18**  
More than 99.9% of the known universe is made of the fourth state of matter - Plasma! Visit the Wonderful World of Plasma, a comic book series curated by the scientists and scholars of #IPR. [ipr.res.in/outreach/docum](https://ipr.res.in/outreach/docum)



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**DAE India @DAEIndia · Jun 18**  
Institute for Plasma Research brings #PlasmaScience closer to students. 'States of Matter', the first comic book in the series, has been released in 14 languages and the illustrations are developed by Mr. Ansh Trivedi, a student from Ahmedabad. 2/2



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IPR's comic book on plasma posted on DAE's Twitter page. The DAE Twitter post can be accessed [here](https://twitter.com/DAEIndia/status/1544444444). This comic book is being extensively used in IPR's rural scientific outreach programmes

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