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Visit of MoS, MSME to FCIPT

Shri Giriraj Singh, Minister of State for MSME, Govt. of India, visited FCIPT on 10th Oct 2017 to understand first hand, the work related to industrial and societal applications of plasma being undertaken by IPR. The MoS was taken around at FCIPT and shown several of the technologies developed/being developed there. The Minister mentioned that his ministry was in the process of promoting khadi prepared with natural dyeing and expressed that scientific R&D inputs from FCIPT to determine the role of plasma technology in improving dye uptake or colour fastness would be appreciated. The Minister had visited the IPR stall at the Parliament House Annexe, New Delhi during 28th July to 11th August 2017 and had shown interest in using plasma technologies in areas of interest to MSME such as plasma nitriding for tool rooms etc..

The MoS was accompanied by Shri Sanjay Hedao, Director - KVIC; Shri B. N. Sudhakara, Director – MSME Development Institute, Shri Jaikrishna, PS to MoS and other members of KVIC. The visitors were initially briefed about the technologies being showcased to the MoS. The MoS also appreciated the work being carried out on societal applications of plasma and suggested many areas where plasma technology could possibly help.



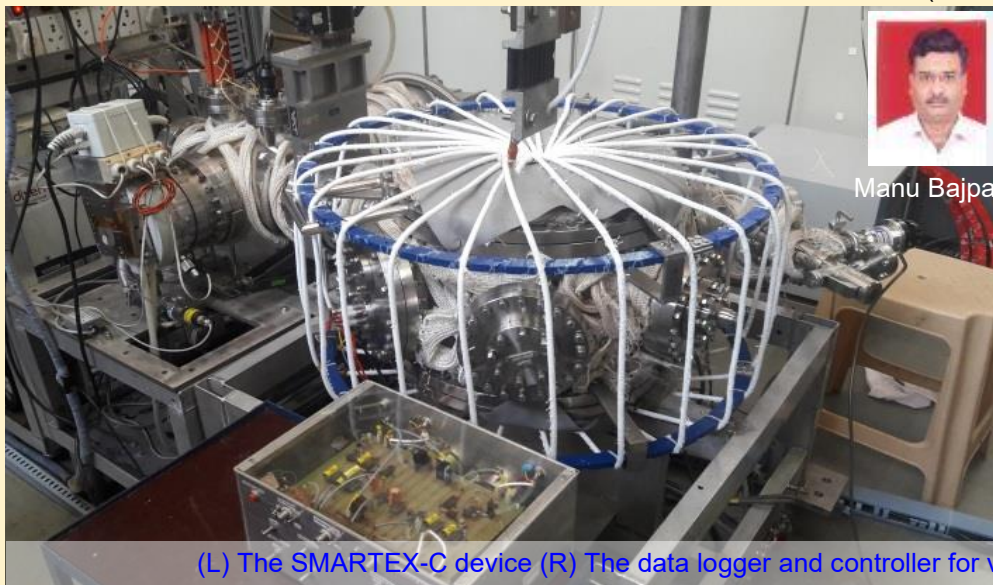
L-R top : The MoS being received at FCIPT; . Bottom : The MoS and his team being briefed about the activities of FCIPT.



L-R top : The MoS being shown plasma treated wool and jute; Plasma nitriding process. Bottom : The MoS with the FCIPT staff.

Recent Developments in Non-Neutral Plasma System : SMARTEX-C

The baking system for the SMARTEX-C has been equipped with 10 heating coils wound around the vacuum vessel and powered through relays. The vessel temperature is monitored from thermocouples and controlled through programmable data logger. The base pressure inside vacuum vessel dropped down to 1×10^{-9} mbar post baking for 48 hours at 180 deg. The vacuum pumps that pump down the vessel are (a) a 500 lit/s TMP backed by penta-line 30 rotary pump and a 4000lit/s cryo-pumping unit. An improved TF coil with 24 turns, made from silver coated multiple-strand copper cable of about 10mm diameter (AWG-2) has been installed. This coil has a cold resistance of about 25 m-Ohm and induces a toroidal magnetic field of 600 Gauss for 4 seconds and 1200 Gauss for 2 seconds at minor axis (135mm from major axis) of the vessel.



Manu Bajpai



(L) The SMARTEX-C device (R) The data logger and controller for vessel temperature control

Visit of IAEA Officials for FEC-2018

IPR will be hosting the 2018 Fusion Energy Conference (FEC-2018) during the 3rd week of October, 2018, and in this regard, three officials from the IAEA visited IPR during 9-11 October 2017. The IAEA team consisted of Ms. Salwa Dallalah, Director, MTCD and Division of Conferences & Documentation Services, Ms. Sehila Maria Gonzales de Vicente, Department of Physical and Chemical Sciences and Ms. Martina Neuhold (Division of Conferences & Documentation Services). The IAEA team had detailed discussions with the Organizing Committee of IPR on various aspects of organization of the FEC 2018 and also visited the venue (Mahatma Mandir, Gandhinagar) and took stock of the facilities available at the venue as well as logistics and other aspects of hospitality and medical facilities that would be made available to the participants.



(L) The IAEA team meeting the Director, IPR. (R) Dr. D Raju (Convener, FEC-2018), Dr. Shashank Chaturvedi (Director IPR), Ms. Salwa Dallalah (IAEA), Ms. Sehila Maria Gonzales de Vicente (IAEA) and Ms. Martina Neuhold (IAEA).



The IAEA and IPR team at the Mahatma Mandir, discussing various aspects of organization of the FEC 2018.



The IAEA and IPR team at the Mahatma Mandir.

Visit of IAEA Officials for FEC-2018... Continued

The IAEA team also took time out from their busy schedule to visit some of the labs at IPR, IPR extension Labs and also FCIPT. They were introduced to the basic experiments at tokamak systems at IPR, fusion related labs such as the High heat flux facility, fusion fuel cycle laboratory, robotics development related to fusion devices as well as the laboratory for development of large cryogenic pumps at the IPR extension laboratories. The team also visited few of the ongoing activities in development of plasma applications being carried out at FCIPT.



The IAEA team visiting various labs in IPR/IPR extension labs (L) LVDP lab (R) High heat flux facility



The IAEA team visiting various labs in IPR extension labs/ FCIPT (L) Robotics lab (R) Cryopump development lab



The IAEA team visiting various labs in IPR extension labs/ FCIPT (L) Fusion Fuel Cycle lab (R) Plasma pyrolysis lab

The RHRTD division, IPR is responsible for developing robotics technologies and resources for *inspection*, *remote maintenance* and *remote material handling* for in-vessel tokamak components. Some of the core development areas are, structural design and multi-body dynamics of high payload robotic systems (>25kg), real time control systems of robotic systems with active Virtual Reality (VR) interface, VR applications development of design review and path planning, and visual feedback control of robotic systems using image processing. The latest RH system indigenously developed by RHRTD – *Articulated Robotic Inspection Arm (ARIA)* – is a 6-Degrees of Freedom, ~2m long system that can be deployed within a toroidal tokamak environment using a linear drive. ARIA can handle cantilevered payload of up to 25kg with a positional accuracy of <2mm. It is operated with a VR interface that enables the operator to precisely control the system from a remote location. As a part of the future deliverables, the division is fostering two new robotic systems - highly dexterous light weight hyper-redundant inspection system (Hy-RIS) and upgraded vacuum compatible version of ARIA. Hy-RIS can be used to carry out inspections activities at constrained locations. A prototype has already been developed and tested. The vacuum compatible version of ARIA can be used for visual inspections within an environment with vacuum levels of 1e-6mbar and up to 80°C ambient temperature. A consolidated virtual reality facility for centralized control and monitoring of RH operations – *Virtual*



Members of the RHRTD Division : (L-R) Raviranjana Kumar Tiwari, Stephen M Manoah, Naveen Rastogi, Krishan Kumar Gotewal, Pramit Dutta

and Augmented Reality Integrated Development Lab (VARID-Lab) – has been setup. The VARID-Lab provides a modular architecture for supervisory control of existing and new robotic systems. It is consistently used for VR application development for haptic force-feedback, image processing, virtual walk-throughs and kinematic simulations. The division is also developing an immersive VR facility for IPR. The VR facility will virtually simulate the desired environment and robotic equipment using a 3D immersive stereoscopic vision. This facility will be used for 3D visualization and interaction of CAD models and shall communicate information about that model to a wide audience. The facility can be effectively used for concept design evaluation, design reviews, RH task simulations, and online control of RH equipment. The RHRTD division, has

also successfully delivered international projects on design, analysis and control system prototyping for JET and ITER.

Talk on “Ethical Behaviour at Workplace”

A talk on “Ethical behaviour at workplace” was delivered by Mrs. Vaibhavi Nanavati, an eminent lawyer of the Gujarat High Court. She emphasized on the model code of conduct between female and male employees at office, so that, not only intentional harassment but also frivolous comments that might be construed as harassment, can be avoided. She also explained the Sexual Harassment Act, its various provisions citing examples to explain it in detail.



(Left) Mrs. Vaibhavi Nanavati delivering the talk. (Right) View of the attendees at the talk.

Seven sectors of the ITER Cryostat Lower Cylinder Tier-2 weighing a total of 190 tons was shipped from Hazira port near Surat to the ITER site in France on 1st October, 2017 and is expected to reach its destination by early November. These sectors will further undergo sub-assembly activities at the on-site workshop.



IPR@Conferences



Ms. Priti Kanth, PhD Scholar, won the second prize for the poster entitled "*Development of Multipoint Nuclear Activation Code for Fusion Devices*" presented at the International Conference on High Energy Radiation and Applications (ICHERA-2017), which was held at the Maharaja Sayajirao University of Baroda, Vadodara, Gujarat from 10-13 October 2017.



Mr. Santosh P. Pandya was awarded a Springer Prize for his presentation "*A synthetic diagnostic to simulate bremsstrahlung emission from the confined runaway electrons in tokamaks and application for runaway electron diagnostic design*", co-authored by Laura Core, Alexander Shevelev, Joël Rosato, Robin Barnsley, Roger Reichle, Luciano Bertalot, Michael Lehnen and Michael Walsh at the Summer School of Plasma Diagnostics (PhDiaFusion 2017) was held at Podlesice, Poland from 11-15 September 2017.



Mr. Rajiv Sharma delivered an invited talk entitled "*Dissimilar Materials Joining and Helium leak tightness at high pressure and cryogenic temperature*" on 13 October 2017 at ISRO Propulsion Complex (IPRC), Mahendragiri, Tamilnadu. At the meeting organized for the Collaborative Research/Development work with Indian Space Research Organization (ISRO)



IPR Team attended the 1st Asia Pacific Conference on Plasma Physics (AAPPS-DPP 2017) held at Chengdu, China during 18th September to 23rd September, 2017. The conference was hosted by the Southwestern Institute of Physics (SWIP), PRC. (L-R) Minsha Shah, Rakesh Tanna, Sudip Sengupta, M. Kikuchi (AAPPS-DPP Chair), Abhijit Sen and Subroto Mukherji.

Pulsed Plasma Accelerator Laboratory (PPAL) @ CPP-IPR

The Pulsed Plasma Accelerator Laboratory (PPAL) of CPP-IPR has an indigenously built Pulsed Plasma Accelerator (PPA) facility powered by a 200 kJ Pulsed Power System (PPS). The system can generate a high density ($n \approx 10^{21}/\text{m}^3$), high velocity, ($\approx 20\text{km/s}$) Plasma Beam. The behavior of the plasma beam and its application is an interesting subject for fusion science in general, and for plasma-matter interaction research in particular.



Members of the PPA Laboratory (L to R): Dr. T. K. Borthakur (Scientist-SE), Mr. C. J. Rajbongshi (Tech. Asstt., Project), Dr. N. K. Neog (Scientist-SD), Dr. N. Talukdar (PDF).

Construction of Neutronics Laboratory building is in progress. The ground floor slab of the laboratory area of the building has been cast. The generator hall above plinth wall work is in progress. For the Laboratory & Auxiliary buildings, laboratory building structural steel works, RCC slabs at all levels, flooring works and roof panel works are almost completed. All Rolling shutters and 5 out of 6 Overhead shutters of Laboratory building are installed. Wall paneling, dry wall partition, floor densification, painting and elevators installation works are in progress. Most of the electrical panels and chillers have been placed in their respective positions. General development works in the vicinity of the buildings are also in progress.



(L) The Neutronics building under construction (R) Inside the Laboratory Building



(L) The completed roofing of the Laboratory Building (R) Development work around the Laboratory building



A Floral *rangoli* created by Ms. Falguni Dave, Ms. Hetal Pathak and Ms. Kanchan Thanvani at the IPR reception area on the occasion of Diwali.

(L) The completed steel structure of the Laboratory building

- ♦ **Dr. Kamakshi Patel**, Sardar Patel University, Gujarat, gave a talk on "Structural, optical, magnetic and biological studies of undoped and doped ZnS nanoparticles" on 26th September 2017
- ♦ **Prof. R.P. Singh**, Physical Research Laboratory, Ahmedabad, Gujarat, gave a talk on "Orbital angular momentum of light and applications in quantum communication" on 28th September 2017 (Colloquium # 278)
- ♦ **Dr. Rajeev Kumar**, GB Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, gave a talk on "Challenges of Agriculture and its possible solution by Plasma Technology" on 6th October 2017
- ♦ **Mr. Abhyuday Chatterjee**, Laboratoire de Physique des Plasmas, PSL Research University, Palaiseau, France and Synchrotron SOLEIL, Gif Sur Yvette, France, gave a talk on "Metastable Molecules and atomic oxygen in O₂ Plasmas probed by High-Resolution Fourier Transform Absorption Spectroscopy & TALIF technique" on 10th October 2017
- ♦ **Dr. Vikram Sagar**, Harbin Institute of Technology, China, gave a talk on "Dynamical Processes Over Complex Networks" on 11th October 2017
- ♦ **Dr. P.N. Maya**, ITER-India, Institute for Plasma Research, Gandhinagar, gave a talk on "Erosion, Re-deposition & Neutron Damage: Recent Investigations in Plasma-Material Interactions" on 26th October 2017

Upcoming Events

- ♦ 10th Non Local Thermodynamic Equilibrium (NLTE) Code Comparison Workshop, San Diego, CA, USA., 28 November-1 December 2017 <http://nlte.nist.gov/NLTE10/>
- ♦ Atomic Data and Analysis Structure (ADAS) Workshop 2017, Abingdon, UK., 04-05 December 2017 <http://www.adas.ac.uk/workshop2017.php>
- ♦ Joint Meeting of 26th International Toki Conference (ITC-26) and 11th Asia Plasma and Fusion Association Conference (APFA-2017), Toki-City, Gifu, Japan, 05-08 December 2017 <http://itc.nifs.ac.jp>
- ♦ 5th Conference on High Intensity Laser and Attosecond science in Israel (CHILI), Tel-Aviv, Israel, 11-13 December 2017 <http://tailus.tau.ac.il/chili2017/>
- ♦ Al Azhar's 14th International Conference on: Engineering, Architecture and Technology, Cairo, Egypt, 12-14 December 2017 <https://www.ierek.com/events/al-azhars-14th-international-conference>
- ♦ 11th International Radar Symposium India (IRSI-17), Bangalore, 12-16 December 2017 <http://www.radarindia.com/>
- ♦ IOP BRSG Christmas Meeting, London, UK, 13 December 2017 <https://www.events.iop.org/e/brsg-christmas-meeting-123547914/page.html>
- ♦ 25th National Conference on Internal Combustion Engines & Combustion-2017, National Institute of Technology Karnataka, Surathkal, 15-17 December 2017 <http://www.nitk.ac.in/news-announcements-tenders/xxv-national-conference-internal-combustion-engines-and-combustion-2017xxv>
- ♦ DAE-BRNS Symposium on Nuclear Physics, Thapar University, Patiala, 20-24 December 2017 <http://sympnp.org/snp2017/>

Know Our Colleagues



Mr. Jashwant Sonara joined IPR in 1998 in Pulsed Power Group where he contributed making various HVDC power supplies and high energy HV capacitor banks. Later he worked for Aditya Vacuum Group designing and installing HV power supply for RF assisted glow discharge cleaning. He moved to the new NINB group where he designed and got commissioned 2 MVA power distribution system required to operate RF generator subsystems and helped setup the RF generator. He joined ITER in 2010 as Cable Database Engineer in Electrical Eng. division where in 5 years compiled 80,000 cables and registered it into ITER's central database. He was involved in the cable engineering design and generation of cables/tray routing network and engineering diagrams using CAD and CATIA tools. Many major challenges were successfully met during these years in this field and the work has been published as an international paper at SOFT-2014. He returned to IPR in 2015 and is working for INTF and has already designed and specified 1MVA Auxiliary power distribution system for INTF sub-systems and also the INTF/TS common control room set-up. He is working now to get both systems installed and commissioned and readying for the operation of the INTF.

Mr. Hiralal M Jadav joined IPR in 1998 and now works as an engineer in the RF group. He contributed for the Control and Data acquisition of the ICRH system and involved in the design, development, integration and testing of DAC systems for the High power tetrode based RF generator. He developed different interlock protection circuits, Signal processing front end electronics, hardware circuits cards for signal interface for many stage High voltage power supply remote control integration and also involved in the operation of ICRH system with ADITYA and SST tokamak RF experiments. He also worked on control and monitoring system PLC, Motor control signal and testing of data acquisition modules.



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