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TO CATALYSE INDO-GERMAN STRATEGIC R&D PARTNERSHIPS



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Mr. S. K. Varshney and Ms. Kathrin Meyer unveiling the IGSTC Annual Report

Governing Body & Finance Committee Meetings

The 14th Governing Body (GB) meeting of IGSTC was held at Thiruvananthapuram on 22nd November 2022. The GB comprises of Mr. S. K. Varshney (DST & Indian Co-Chair), Ms. Kathrin Meyer (BMBF & German Co-Chair), Mr. Vishvajit Sahay (FA, DST), Prof. Neelima Gupta (Sagar University), Ms. Andrea Frank (Stifterverband), Dr. Tata Narasinga Rao (ARCI), Dr. Martin Goller (BMBF), Mr. Kaspar Meyer (German Embassy, New Delhi), Mr. Sanjeev Rangrass (Zetwerk Mfg Businesses Pvt Ltd), Mr. Clas Neumann (SAP). Dr. Ulrike Wolters (BMBF), and Dr. Sibashisa Dash (DST) as member secretaries. Mr. R. Madhan (Director), Dr. P V Lalitha, Mr. R Varadarajan, Mr. Hans Westphal (DLR-PT), Ms. Doerte Merk (DLR-PT), Dr. Rupak Bhattacharya, Mr. Saquib Shaikh and Mr. Pankaj Kothari represented IGSTC in the meeting. The GB thanked the outgoing members Prof. Sandeep Verma and Mr. Philipp von Ritter for their contributions to IGSTC. The GB meeting focused holistically on IGSTC's activities, 2 + 2 flagship programme, thematic areas for future grant calls and future direction ahead.

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Group photo of the 14th Governing Body Meeting

The 7th Finance Committee (FC) meeting took place on 2nd November 2022 through virtual mode. The FC comprises of Mr. Vishvajit Sahay (Financial Advisor, DST and Indian Co-Chair of FC), Dr. Ulrike Wolters (BMBF and German Co-Chair of FC), Dr. Martin Goller (BMBF) and Dr. Sibashisa Dash (DST). Mr. R. Madhan (Director, IGSTC), Dr. Rajeev Kumar (DST), Mr. R Varadarajan (Manager, IGSTC), Mr. Pravin Gupta (Financial Consultant), Mr. Hans Westphal (DLR-PT/IGSTC) attended the meeting. Discussions held and decisions were taken on financials, audit report and budget estimates for IGSTC.



14th Governing Body Meeting



7th Finance Committee Meeting

2+2 Projects

NOMIS MAMM-WAAM

Project Monitoring Meeting of 2+2 Projects

CO2BioFeed HERCET CleanWater SELBA

EffectroH₂O

> NOMIS

Non-enzymatic microfluidic electrochemical multiplex sensor for cost-effective soil testing



IGSTC 2+2 Project NOMIS team

Pesticides and fertilisers are often used to enhance agricultural output. However, these substances are responsible for causing biomagnification, which has harmful effect on human life and the environment, as they ascend up the food chain. The majority of currently utilised techniques for detecting fertiliser and pesticides in soil are costly and challenging to implement in a device outside of a laboratory setting. The project intends to solve this unmet problem by developing an effective multiplexed device for the detection of nitrate (a significant fertilizer-based soil/ground water contaminant in India and Germany) and organophosphates (a class of pesticides) in soil samples. The device will include a microfluidic platform with printed electrodes made from formulations of analyte-sensitive ink, and it will make it much easier for regular screening of nitrate and organophosphate to monitor the quality of soil sample. This device, planned for commercial marketing, will be a crucial step towards sustainable agriculture, improving the lives of rural farming communities in the countries and protecting water resources from contamination. The project is partnered by Dr Gorachand Dutta, IIT Kharagpur & Dr Amit Rastogi, Coromandel International Ltd. from India and Dr Bernhard Wolfrum, Technical University (TU) Munich & Dr Joachim Wiest from cellasys Germany.

The German partners of this project visited IIT Kharagpur, India from October 10th to October 13th, 2022 and the full consortium met in-personon October 11th, 2022 to discuss about the project's progress. Partners from IIT Kharagpur presented their work on composites for nitrate detection which involves the usage of electrodeposited Cu nanoparticles along with FWCNT (Few Walled Carbon Nano Tube) and introduced the synthesis and sensing data of a new Cu-organic amine nanocomposite with FWCNT as a second and better strategy for nitrate sensing. A detailed discussion on the electrochemical data for the two different copper nanoparticles and their corresponding

sensing performance were compared from which the conclusions were drawn that stability of the new Cu-organic amine nanocomposite is better than the former one. Partners from TU. Munich brought the gold microelectrode array sensor chips and handed over some substrate samples to IIT partners for further electrochemical sensing analysis. The team also discussed about the organophosphate detection strategies and challenges ,along with the update on test binding affinity study performed on organophosphate binding aptamer by SPR (Surface Plasmon Resonance) analysis. The Indian industrial partner emphasized on the necessary modifications of the final device for soil testing analysis so that it can be easy-to-use and convenient to carry in the farm by the farmers to monitor soil fertility/pesticide and the ease of operation should allow also an untrained person to use it. cellasys GmbH brought the portable handheld device prototype and also discussed on commercialisation plans. The project partners discussed the roadmap and work packages of the project in detail and implemented the strategy towards the completion of the whole device development.

>MAMM-WAAM

Multi-axis multi-material wire arc additive manufacturing

Multi-Axis multi-material wire arc additive manufacturing (MAMM-WAAM) is an additive manufacturing (AM) system that can efficiently fabricate large-scale metallic objects (of size up to 2m 1m) of Functionally Graded Materials (FGMs). It is a hybrid (Additive - Subtractive) robot cell consisting of two multi-wire plasma welding torches attached to two 6-axis robotic arms mounted on curved/linear tracks and a 6-axis robotic arm for machining the near-net shapes. The project is partnered by Dr. Sajan Kapil, IIT Guwahati; Dr. Mohit Law, IIT Kanpur; Dr. Vishwas R Puttige, Ace Manufacturing Systems Ltd. from India and Mr. Rahul Sharma, RWTH Aachen University; Dr. Denys Plakhotnik, ModuleWorks GmbH from Germany. Dr. Vishwas R Puttige visited the ModuleWorks GmbH and RWTH Aachen University - German project partners in November 2022 and initiated the discussion on the development of this Hybrid - Manufacturing system. Recently, a team of researchers from IIT Guwahati visited the German counterpart in December 2022 for two weeks, discussed and understood the critical collaboration aspects, and assigned the initial tasks among the team members. Each project partner presented their ongoing research & development activities at their respective organizations. Closely observed and conducted preliminary experiments on the existing Plasma Additive Manufacturing (PAM) facility of RWTH Aachen University and discussed the possible challenges for the MAMM-WAAM. German project partners will be visiting Indian project partners in March/May 2023.



Discussion meeting at RWTH Aachen. Left to Right: Dr. Denys Plakhotnik (ModuleWorks GmbH), Dr. Rahul Sharma (RWTH Aachen), Mr. Johannes Kellerwessel (RWTH Aachen), Dr. Mohit Law (IIT Kanpur, online) Dr. Vishwas R Puttige (ACEAMS Bangalore), Dr. Sajan Kapil (IIT Guwahati), Mr. Ritam Sarma (IIT Guwahati), Mr. Ambrish Singh (IIT Guwahati)



Indian team at the facilities of the Welding and Joining Institute of RWTH Aachen. Left to Right : Mr. Johannes Kellerwessel (RWTH Aachen), Dr. Sajan Kapil (IIT Guwahati), Dr. Rahul Sharma (RWTH Aachen), Dr. Denys Plakhotnik (ModuleWorks GmbH), Mr. Ritam Sarma (IIT Guwahati), Mr. Ambrish Singh (IIT Guwahati)

Project Monitoring Meeting of 2+2 Projects

CO₂ and biomass as feedstock for the production of energy carriers and chemical intermediates



The project focusses on the use of the greenhouse gas CO₂ from sustainable sources, or biomass as a renewable carbon feedstock for the production of alternative energy carriers and industrially relevant high value chemical intermediates. Project is partnered by Prof Asim Bhaumik, Indian Association for the Cultivation of Science

(IACS), Kolkata; Prof Biswajit Chowdhury, Indian Institute of Technology (IIT-ISM), Dhanbad; Dr. Praveen Kumar Chinthala, Reliance Industries Limited, Jamnagar from India and Prof Thomas Ernst Müller, Ruhr-Universität Bochum; Mr Jens Hannes, RWE Power AG; Mr. Gernot Nell, Parr Instrument GmbH from Germany.



Development and validation of a cost-effective hybrid electric drive solution for small two wheelers for reducing CO, emission



The objective of this project is to develop a cost-effective hybrid two-wheeler fulfilling the requirements of reduced CO₂ and other emissions and improved fuel economy. In the project, IIT Madras and RWTH Aachen are developing and integrating simulation models of the engine and the vehicle along with the electric drive for sizing the important components and will arrive at the suitable topology and control strategies. The hybrid electrical drive control units and the battery management system will be developed by VEMAC GmbH, Germany. TVS Motor Ltd., India will do the design, component procurement and integration on test bed and vehicle.

> Clean Water

Modular lightweight wastewater treatment units made with TRC for rural and periurban dwellings



The aim of this project is the realization of an innovative lightweight, modular WTP made with Textile Reinforced Concrete (TRC). The advantage of a modular WTP design lies in a decentralized production facility, whereby all the necessary plant components have to be delivered to the construction site and assembled. The project is partnered by Prof. Ravindra Gettu, IIT Madras; Dr. Smitha Gopinath, CSIR-SERC, Dr. Mohit Raina, Raina Industries from India and Prof. Till Quadflieg, RWTH Aachen and Mr. Oliver Hentzschel, Betonwerk Hentzschel GmbH from Germany.

> SELBA

Advanced lithium ion transporting solid electrolytes for solid-state lithium batteries



The project is partnered by CSIR-CECRI (Dr. A.S. Prakash), IISc Bangalore (Prof. S Sampath), Amara Raja Batteries Limited (Dr. M Venkateswarlu / Dr Ebenezer D) from Indian side and Karlsruhe Institute of Technology (Prof. Maximilian Fichtner), Daimler AG (Dr. Thomas Soczka-Guth) from German side. The main objective of the project is to develop a new (fluoride-based) and advanced Li+ conducting solid electrolytes with high interfacial and electrochemical stability. The project also aims to develop lithium-free and lithium deficient high specific energy cathode materials for their employment in a future generation of all-solid-state lithium batteries.

>EffectroH₂O

Effect-based monitoring demonstrates efficiency of electrically-driven water treatment processes to remove salts and micropollutants from process water



This project partnered by Prof. Indumathi Nambi, IIT Madras; Mr. I Sajid Hussain, Tamilnadu Water Investment Company (TWIC) from India and Prof. Henner Hollert, Goethe University, Dr. Viktoria Schiller, Eurofins Agrosciences from Germany aims at improving the process water treatment in industries in order to reduce harmful toxicological effects in receiving environments. EfectroH2O targets the United Nations Environment Programme Sustainable Development Goals 6 to "Ensure availability and sustainable management of water and sanitation for all" by contributing to the reduction of water consumption in water scarce regions such as India.



Dr. Srivari Chandrasekhar, Secretary, Department of Science & Technology delivering a talk on chemical systems and processes at the workshop

Indo-German workshop on complex chemical systems

Indo-German Workshop-2022: **Complex Chemical Systems** (IGW-CCS-2022) was an interdisciplinary Workshop focused on chemistry and Chemical Biology. This workshop brought chemists from India and Germany/Europe under the thematic title of Complex Chemical Systemsto intensify scientific interaction among leading researchers in India and Germany. It enabled researchers to identify areas where scientific collaboration might be possible to understand complex chemical systems better by developing new catalysts and value-added molecules mainly focused on healthcare & well-being including new materials.

This bilateral Indo-German Workshop was conducted by Prof. G. Sekar (Convener, Department of Chemistry, IIT Madras) and Prof. Dr. Alexander Heckel (German Coordinator, Goethe-University Frankfurt, Germany) during October 5-9, 2022, funded by the IGSTC.

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Participants at the workshop

IGW-CCS-2022 focused on varied aspects of chemistry, biology, and material science. This unique gathering offered an opportunity for scientists from both countries to meet and engage in the exchange of cutting-edge research ideas, build long-term networking, and explore bilateral research collaborations. In this meeting, 11 European scientists (9 from Germany, one each from Iceland, and the Czech Republic) and 17 Indian scientists delivered 30 lectures and a one-panel discussion on "Sharing knowledge through open science and open access" moderated by Padma Shri, Prof. V. K. Singh (IIT Kanpur). In addition to that, well-established Indian scientists such as Dr. Srivari Chandrasekhar (DST secretary), Padma Shri, Prof. Sandeep Verma (Secretary, SERB) and Mr. R. Madhan

(Director, IGSTC) attended the conference as special invitees whose presence/interaction/guidance helped young Indian faculty to motivate their research networking.

At this conference, several representatives were present from the pharmaceutical industry and scientific publishers such as ACS, RSC, and Wiley-VCH.

The first-day event took place (Oct. 05, 2022) at IIT Madras with six lectures and around 250 participants attended this first-day event. The remaining days (Oct. 6-9, 2022) workshop took place at Hotel Taj Fisherman's Cove, Kovalam, Chennai. Several collaborative projects are expected from this Indo-German workshop.

Women Involvement in Science and Engineering Research (WISER)

First batch of awardees

IGSTC had launched the Women Involvement in Science and Engineering Research (WISER) programme on 24th November 2021. WISER aims to promote women researchers in Science, Technology, Engineering and Mathematics (STEM) to create avenues for networking, interaction and long-term research collaboration. Through this scheme, women researchers/entrepreneurs holding a regular position in academic/research institutions/industrial research organisations in India/Germany may apply to be a part of an ongoing R&D project of interest with acceptance from the host team. WISER is open to all the areas of STEM and the tenure will be for a period of 3 years or till completion of the project whichever is earlier and will cover one visit per year for short stay up to 1 month at the host's organisation.

The financial assistance under this scheme for Indian Awardee is upto ₹ 39 lakhs and for German awardee it is € 48000 for 3 years.

IGSTC has received a tremendous response in applications and after a diligent evaluation, 10 awardees from India and 1 from Germany have been recommended for award. The following are the brief profiles of 11 successful candidates for WISER.



Dr. Gayathri Pananghat IISER Pune

Host: Max Planck Institute for Terrestrial Microbiology, Marburg

Area of Work: Structural and biochemical characterization of protein complexes in myxococcus xanthus polarity regulation



Dr. Shrutidhara Sarma IIT Jodhpur

Host: TU Braunschweig

Area of Work: Towards development of ultrasensitive strain measurement system using laminated nanocomposites. (TESSLA)



Dr. Manju Nanda CSIR-National Aerospace

Laboratories, Bangalore Host: German Aerospace Centre (DLR) , Braunschweig

Area of Work: Design, develop and propose a regulatory framework for model-based safety assessment towards software health management



Prof. Dipti Gupta

IIT Bombay

Host: Karlsruhe Institute of Technology (KIT), Karlsruhe

Area of Work: An integrated liquid/electrolyte gated transistor (EGT) technology platform for rapid, detection of cancer-associated extracellular vesicles



Dr. Poulomi Ganguli IIT Kharagpur

Host: GFZ German Research Centre for Geosciences, Potsdam

Area of Work: CRA floods: compound risk assessment of heat-stress induced pluvial floods



Prof. Meenu Saileshkumar Saraf

Gujarat University Ahmedabad

Host: Leibniz Institute DSMZ-German Collection of Microorganisms and Cell Cultures, Braunschweig

Area of Work: Nutrient dynamics and functional aspects of microbial diversity in saline soils



Dr. Thanammal Ravichandran Kumaraguru College of Liberal Arts and Science, Coimbatore

Host: University of Hohenheim, Stuttgart

Area of Work: Potential of digital innovations and its institutional dimensions to enhance dairy productivity in developing countries



Dr. Janani Srree Murallidharan IIT Bombay

Host: TU Darmstadt

Area of Work: Computational modeling of boiling heat transfers



Prof. Radha Chaube Banaras Hindu University Varanasi

Host: Ludwig-Maximilians-University, Munich

Area of Work: Brain endocrine indicators of welfare in fish subjected to autogenous vaccine against bacterial infection



Dr. Rajamalli Pachai Gounder IISc Bangalore

Host: Kurt-Schwabe-Institut für Mess- und Sensortechnik Meinsberg e.V, Waldheim

Area of Work: Design and synthesis of multi-resonance thermally activated delayed fluorescence emitter for optogenetics and imaging applications



Ms. Rahel Krause RWTH Aachen University

Host: IIT Delhi

Area of Work: Heat transmission through multilayered clothing under extreme heat and fire conditions

> WISER AWARD CEREMONY



Indian WISER awardees

IGSTC has organised the WISER Award Ceremony on 18th October 2022 to felicitate all the Awardees. The event was graced by H.E. Dr Philipp Ackermann, German Ambassador to India & Bhutan, Prof. Santishree Dhulipudi Pandit, Vice Chancellor, Jawaharlal Nehru University and Mr. S. K. Varshney, Adviser & Head, International Division, DST & IGSTC Co-Chair, GB. Dr. Ackermann appreciated the women researchers' efforts in niche science & technology areas and said that their contribution would strengthen Indo-German collaborations in S&T. "Initiation of a programme like WISER would motivate women researchers to excel and take up leadership positions in Science & Technology," said Prof. Pandit. The event was well attended by representatives from DST, German Embassy, Delhi, CEFIPRA, TDB, DAAD, and other funding agencies. The German Awardee was felicitated on 21st September 2022 with the certificate in Aachen, Germany in the presence of members of IGSTC Secretariat and German Project Office.





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>WISER CONNECT

Spread of Institutions networked across India & Germany through WISER



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Paired Early Career Fellowship in Applied Research (PECFAR)

First batch of awardees

Paired Early Career Fellowship in Applied Research (PECFAR) is a new initiative to facilitate research and networking among Early Career researchers from India & Germany through a short-term exchange visit up to 2 months was launched on 1st February 2022. PECFAR provides grants for research stay & networking including monthly fellowship along with international travel support & medical/travel insurance cost for the visit to the host country.

In the first Call, IGSTC awarded the fellowship to 11 pairs of Early Career researchers from various academic institutions in India & Germany. It is envisaged that such engagements through networking would further establish long-term bilateral collaborations and provide an opportunity to explore the Indian and German research landscape for potential collaborations in future. IGSTC organised a virtual Award Felicitation Ceremony on 15th November 2022. Mr. S. K. Varshney, Adviser & Head, International Cooperation, Department of Science and Technology (DST), Govt. of India & Indian Co-Chair, IGSTC GB and Ms. Kathrin Meyer, Head of the Division Cooperation with Asia and Oceania, Federal Ministry of Education and Research (BMBF), Govt. of Germany & German Co-Chair, IGSTC GB addressed the Awardees and inspired them to take the opportunity to visit India and Germany for exploring various S&T aspects. Each pair of Indian and German Awardees pitched their views on the programme and expressed how such opportunities will strengthen their future research endeavors.



PECFAR Award Felicitation Ceremony (virtual) on 15th November 2022

Brief profiles of the selected Pairs of PECFAR awardees from India and Germany are detailed below

Pair 1

IISc Bangalore & TU Munich



Tarun Rambha Assistant Professor IISc Bangalore

Pair 2

Maximilian Schiffer Assistant Professor TU Munich

Area of Work: Smart transportation using Autonomous Mobility-on-Demand

(AMoD) and public transit (PT) systems.

IIT(ISM) Dhanbad & TU Munich

Surabhi Jain Post-Doctoral Researcher IISc Bangalore



Ana Paula Ribera Diploma Engineer TU Munich

Area of Work: Investigation of mechanical behaviour of biochemically stabilized tailings to

stabilized tailings to mitigate the failure of tailing storage facilities.

Pair 3

IIT Gandhinagar & Helmholtz Institute Freiberg



Pankaj Khanna Assistant Professor IIT Gandhinagar



Samuel Thomas Thiele Post-Doctoral Researcher Helmholtz Institute Freiberg Area of Work: To develop outcropping reservoir

analogues to unlock the geothermal potential of India.

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Pair 4

IIT Bombay & RWTH Aachen University



Area of Work:

Understanding thermal transport properties of materials for thermoelectric applications and computational discovery of catalyst for thermochemical reactions.



Abhishek Khetan Junior Professor RWTH Aachen University

Area of Work:

Computational modelling and simulations for discovery of highly soluble battery molecules and highly active catalyst.

Ankit Jain Assistant Professor IIT Bombay

Pair 5

IISc Bangalore & Paderborn University



Sai Gautam Gopalakrishnan Assistant Professor IISc Bangalore



Hans-Georg Steinruck Assistant Professor Paderborn University

Area of Work:

Theoretical and experimental development of Ca-ion intercalation of electrodes using multi-scale theory.

Pair 6

Central University of Punjab & RWTH University Hospital



Uma Shanker Assistant Professor Central University of Punjab

Area of Work: Translational liver research to study hepatic disorders research including Non-alcoholic steatohepatitis (NASH), viral hepatitis, liver cirrhosis and liver failure.



Amit Khurana Post-Doctoral Researcher RWTH University Hospital

Area of Work: Study on

gut-microbiome during the pathogenesis of acute-on-chronic liver failure.

Pair 7

CSIR-CMERI, Durgapur & TU Munich



Saikat Kumar Shome **Principal Scientist** CSIR-CMERI, Durgapur



Amartya Ganguly Senior Scientist TU Munich

Area of Work: Data-driven control strategies for 3D musculoskeletal model of the human hand.

Pair 8

IIT Delhi & TU Munich



Area of Work: Combating Offensive Speech on Social Media: Roles of Language Usages,

Associate Professor IIT Delhi

User Behavior, and Network Structure.



Tanmoy Chakraborty

Pair 9

IIT Mandi & TU Berlin



Prateek Saxena Assistant Professor IIT Mandi

Area of Work: Sustainability and effectiveness of the Laser Powder Bed Fusion (LPBF) based Additive Manufacturing process to design lightweight structures.



Debarghya Ghoshdastidar

W2 Professor

TU Munich

Christian Lahoda Research Engineer TU Berlin

Area of Work: Development a formal framework for attack-defence mechanisms in community detection, inspired by recent advances in adversarial learning.

Area of Work:

Preparation of the feedstock and the identification of suitable process parameters for the qualification of recycling granulate for the additive process.

Pair 10

NIT Rourkela & PTB, Braunschweig



Framework on safety standards for commercializing low temperature thermochemical energy storage device in residential buildings.

Area of Work:

Bukke Kiran Naik Assistant Professor

NIT Rourkela

Sumit Agarwal Project Manager and Scientist PTB, Braunschweig

Area of Work: Thermochemical

energy storage system for building applications.

Pair 11

NIT Srinagar & Hamburg University of Technology



Area of Work: Impact of unscientific solid waste dumping on the nearby water and soil environment.

Khalid Muzamil Gani Assistant Professor NIT Srinagar



Tavseef Mairaj Shah Post-Doctoral Researcher Hamburg University of Technology

Area of Work:

Extent of microplastics (MPs) pollution in agricultural fields and impact of the unscientific solid waste disposal in rural areas on agricultural crop production.

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> PECFAR CONNECT

Spread of institutions networked across India & Germany through PECFAR



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H.E. Dr. Philipp Ackerman with IGSTC staff

German Ambassador visit to IGSTC

IGSTC hosted H.E. Dr Phillip Ackermann, German Ambassador to India & Bhutan at its office in New Delhi on 1st September 2022. Dr. Ackermann had a wide-ranging discussion on bilateral cooperation's with India especially in science sectors. He also interacted with the IGSTC staff and motivated them to take the partnership between the two countries forward. Director, IGSTC also presented various modes of Indo-German S&T networking through IGSTC programmes.



DFG delegation at IGSTC Secretariat

DFG Delegation visit to IGSTC

The delegation from German Research Foundation (DFG) visited IGSTC Secretariat in New Delhi on 19th October 2022. The delegation was led by Dr. Heidi Ahrens, Secretary General, and included Dr. Jörg Schneider, Head, International Affairs, Dr. Ingrid Krüßmann, Deputy Head International Affairs, Dr. Franziska Langer, Director, DFG Office India and Dr Vaibhav Agarwal, Deputy Director, DFG Office India. Mr. R Madhan, Director, IGSTC presented various activities and programs implemented by IGSTC. Discussions focussed on future avenues of Indo-German collaborations through IGSTC and DFG.

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German Consular delegation visit to IARI

German Consular delegation visit to Sensvert project at IARI, New Delhi

A German consular delegation visited the IGSTC 2+2 project site of Sensvert project at Indian Agricultural Institute (IARI) on 21st October 2022. SensVert project under IGSTC's "2+2 Programme" aims to develop an automated sensor system for a highly efficient nutrient management system in vertical farming setup. The delegation included officials from German Embassy, New Delhi and its consulates in Mumbai, Kolkata and Chennai. The visit exposed them to the path-breaking research being carried out in vertical farming under Indo-German collaborations. The project is partnered by Dr. Murtaza Hasan, ICAR-IARI, New Delhi & Mr. Shivendra Singh, Barton Breeze, Gurgaon from India and Prof. Heike Mempel, Hochschule Weihenstephan-Triesdorf (HSWT), Freising, Mr. Mohamed Bourouah, Hahn-Schickard Schwenningen & Mr. Georg Bruckner, Sondermaschinenbau Bruckner GmbH, Marktgraitz from Germany.



Dr. Murtaza Hasan, IARI explaining the vertical farming concept to the delegation





German Science Counsellor visit to CSIR-CLRI

Mr. Kaspar Meyer, Science Counsellor, German Embassy, New Delhi and Ms. Michaela Kuchler, Consulate General of the Federal Republic of Germany, Chennai, visited CSIR-Central Leather Research Institute (CLRI) on 2nd December 2022 to overview the works carried at Indo-German projects funded by IGSTC. The Director, CSIR-CLRI welcomed the officials, interacted, and explained about the technologies and R&D works carried out for the leather industry at the dissemination centre, CLRI, Chennai.

CLRI is implementing an Indo-German 2+2implementing 2+2 project on "Smart Cities Integrated Energy Supply, Carbon Sequestration

30 **IGSTC** NEWSLETTER OF IGSTC Volume 6 | Issue 3 | September - December 2022 and Urban Organic Waste Treatment Through Combined Solar Sludge Drying and Pyrolysis (PYRASOL)" funded by IGSTC along with the German academic partner Prof. Dirk Weichgrebe, Leibniz University, Hannover, and German industrial partner, M/s. Biomacon GmbH, Rehburg, and Indian industrial partner M/s. Re Sustainability Ltd. . The main objective of the project is to generate thermal energy and biochar from the organic fractions of municipal solid waste especially fibrous organic material which is not suitable for anaerobic digestion (banana peduncle) and sewage sludge from sewage treatment plant generated from urban cities using accelerated solar drying system and single chamber pyrolysis. Subsequently, Mr. Meyer and Ms. Kuchler had interacted with Dr. S. V. Srinivasan, Env. Engg. Dept., and also visited the Biogas pilot plant installed under the completed 2+2 project RESERVES and pilot plant facilities installed under the ongoing PYRASOL project.



Group photo of the participants at CSIR-NIIST

IGSTC governing body members visit to CSIR-NIIST

A delegation of IGSTC Governing Body members, BMBF Officials, IGSTC German office visited the CSIR - National Institute for Interdisciplinary Science and Technology (NIIST) on 22nd November 2022. Director, CSIR-NIIST welcomed the delegation and had a brief discussion on Indo-German collaborations. A project exhibition showcasing various activities of the institution was demonstrated to the delegation. An IGSTC presentation highlighting the various funding opportunities was delivered to the NIIST researcher community.



Director, CSIR-NIIST (centre) in discussion with the delegation



Project demonstration at CSIR-NIIST





IGSTC at the Indo-German Frontiers of Engineering Symposia (INDOGFOE) at Bremen

INDOGFOE is a series of interdisciplinary, binational conferences which are co-organized by the Department of Science and Technology (DST) from India and the Alexander von Humboldt Foundation (AvH) from Germany. Funding on the German side is provided by the Federal Ministry of Education and Research (BMBF). The activity brings together outstanding, early-career German and Indian engineers and natural scientists from industry, universities, and other research institutions to introduce their areas of research and technical work, thereby facilitating an interdisciplinary transfer of knowledge and methodology. The symposium promotes the development of cooperative networks among scientists from both countries. This year the INDOGFOE was held during 29th September -2nd October in Bremen.

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Conferences are held bi-annually, alternating between Germany and India, with about 30 scientists from each country participating. An organizing committee comprised of five Indian and five German engineers and natural scientists develops the program for the event.

The following areas have been covered at the 2022 INDOGFOE symposium:

- Electric Vehicle Systems for Future Carbon-Neutral Mobility
- Nanobiotechnology for Life Science
 Applications
- Surveillance vs. Privacy: Data Security in the Digital Age
- Thin Film Science and Engineering

AvH supports such collaborations between German and Indian participants with its special follow-up program "CONNECT" which allocates residence allowances for working visits in the partner countries for up to 30 days. IGSTC finances the "CONNECT Plus" which covers the travel costs to the awardees in the CONNECT Programme.

The Head of the German Project Office IGSTC presented the Connect Plus programme and the full portfolio of IGSTC's funding opportunities to the participants of the event. Several queries especially on 2+2 programme were addressed in the meeting.



IGSTC team at European Space Agency, Cologne

IGSTC staff exchange to Germany

IGSTC staff Mr. Saquib Shaikh, Mr. Pankaj Kothari and Ms. Paridhi Gupta visited Germany for a staff exchange program and spent a week from 19th - 23rd September 2022. IGSTC German office is hosted at DLR-PT in Bonn. Discussions and deliberations on IGSTC programs like 2+2 projects, Workshops, Industrial Fellowship & other matters took place. An overview on German financial and funding system was also learnt upon. The IGSTC Indian and German team visited the European Space Agency, Cologne and learnt about the astronaut training. The staff exchange to DLR-PT and interactions and deliberations with IGSTC German team was highly enriching. A lot of learnings in the German working style can be adopted to enhance efficiency. Culturally, it was an enthralling experience to learn about German public transport system, cuisines.



IGSTC Team during a work discussion

IGSTC Industrial Fellowship

Govind Sahu

Improving machining performance through digital twin

Sanasam Vipej

Punching shear failure of steels

Yugandhara Bhosale Large hybrid drones

Sheena Agarwal

Machine learning methods in quantum chemistry

Harish PV

Modelling High entropy alloys for catalysis

Yamini Mittal

Wastewater treatment through constructed wetlands

> GOVIND SAHU

Improving machining performance through digital twin



Govind characterising dynamics of robotic milling machine

Dr. Govind Narayan Sahu is an IGSTC Post-Doctoral Industrial Fellow (PDIF) at the Fraunhofer Institute for Machine Tools and Forming Technology (IWU), Chemnitz, Germany, under the supervision of Prof. Dr.-Ing. Steffen Ihlenfeldt. He is working on implementing various industry-relevant active damping strategies and regenerative chatter models in the digital process twin of machining processes.

Dr. Sahu completed his doctoral dissertation at IIT Kanpur under the supervision of Dr. Mohit Law. In his PhD, he developed India's first indigenous hardware-in-the-loop simulator to emulate chatter vibrations in machining and tested active damping strategies to damp them and improve productivity.

Prof. Steffen Ihlenfeldt is the Director at Fraunhofer IWU Chemnitz and Professor at Machine Tools Development and Adaptive Controls at the former Institute of Machine Tools and Control Engineering at the Technical University of Dresden. He is leading the scientific field of "Production Systems and Factory Automation".



Toolpath planning for robotic milling operation

Under the IGSTC PDIF fellowship, he aims to improve productivity and reduce the number of trials by optimizing NC tool paths using a physics-based approach and virtual machining process simulation. In addition to optimized cutting conditions, he is using active damping technology to further increase productivity, where the damping forces, inertial mass displacement, coil temperature, and remaining useful life of an active damper can be predicted and virtually visualized. To successfully implement the above ideas, he has created a database by conducting various machining experiments, modal tests of conventional and robotic milling machines at different positions, and various experiments on active damping.

This fellowship has facilitated him to learn about forward-looking technologies such as the digital twin, robotic machining, smart tools, and virtual sensor systems, all of which are valuable and have helped him to expand his professional network. In his free time, he loves to explore the sights and cultural activities in Germany with his colleagues and family.

>SANASAM VIPEJ

Punching shear failure of steels



Dr. Vipej at KoRoH GmbH

Dr. Sanasam Vipej Devi is a resident of Manipur, India. She is working as an Assistant Professor in the Department of Civil Engineering, National Institute of Technology Mizoram. She was awarded the IGSTC Post-Doctoral Industrial Fellowship (PDIF) in the year 2021 and is currently at Center of Competence for Tubes and Hollow Sections (CCTH), KoRoH GmbH, Karlsruhe.

She is hosted by Dr. Stefan Herion, Managing Director (KoRoH GmbH). KoRoH GmbH is an independent engineering office that focuses on providing advice and information on hollow sections and their use in steel and mechanical engineering as well as offshore structures. Their services include proof of stability, fatigue-proof construction, dimensioning and optimization of engineering structures and offshore constructions. They are also active members and participants in various international committees and takes important role in standardization of European design guidelines. In addition, they are committed to research in close cooperation with the leading universities and research institutions in Germany and Europe.



Dr. Vipej (third from right) with her team members at KoRoH

At KoRoH GmbH, Dr. Devi is working as part of a larger German research project concerning Cold-formed high strength steel tubular connections. The objective is to address the typical 'punching shear' failure mode of high strength steel tubular connections. The research work is carried out in a finite element software Abaqus. Suitable material damage criteria is adopted in the finite element model to sufficiently predict the punching shear failure of the connection. She is working in close cooperation with universities who are also research partners of the same project. Through the fellowship and proposed research, Dr. Devi aims to develop an efficient numerical model which can accurately represent material damage in the punching shear failure mode of the tubular connection. The fellowship provided her an opportunity to explore the German research landscape, meet with leading and fellow researchers, and experience an innovative and open-minded research environment. She also got the opportunity to visit and learn about advanced and well-equipped world-class testing facilities in some of the top universities in Germany.

> YUGANDHARA BHOSALE

Large hybrid drones



Yugandhara at Airbus, Munich campus

Yugandhara Bhosale, a doctoral student in the Department of Mechanical Engineering at the Indian Institute of Technology Bombay (IITB) has primary research interest in Robotics and Automated Vehicles. Currently, she is working on the design optimization of the towed underwater vehicle which will be used for underwater pipeline surveillance. Prior to this, she worked on developing high-payload hybrid-powered drones.

As a part of the PhD Industrial Exposure Fellowship (PIEF), she worked at the Airbus Central Research and Technology, Munich, Germany. Airbus is a global leader for the development and manufacturing of defence and space products. It is an international pioneer in the aerospace industry and at the forefront in designing, manufacturing and delivering aerospace products, services and solutions to customers on a global scale. During the fellowship, she was involved in design and fabrication of the flexible payload unit for the communication drone. The task started with analysing and defining structural requirements and constraints for the payload unit. The payload unit had to be conformal with structural and aerodynamics

analysis. The payload unit can be used to accommodate variable height of adjustable compartments depending on the number of components and dimension of each component. The payload unit design was found to be stable after carrying out the flight test with the communication drone. This helped the 1-XRC team to carry out communication testing for various protocols.

This fellowship helped her not only to gain knowledge and skill sets that are practised in the industries but also to expand the network in her domain. It bridged the gap between academic and industrial approaches towards research.

The fellowship in Germany allowed her to make new friends where everyone has a unique background and story. It also sensitised her towards global awareness meaning how environmental, social, and political factors impact the world. Communicating with people from different cultures brought cultural awareness. Overall, this fellowship encouraged her to discover herself more and compelled her to be adaptable and independent.

>SHEENA AGARWA

Machine learning methods in quantum chemistry



Sheena at BASF, Ludwigshafen

Sheena Agarwal is a final year PhD student at CSIR- National Chemical Laboratory, Pune, India. She works primarily in computational quantum chemistry applied to heterogeneous catalysis using tools like Density Functional Theory with machine learning.

Under the PhD Industrial Exposure Fellowship (PIEF), she got the opportunity to work at BASF-SE, Ludwigshafen, Germany. BASF-SE is a German multinational chemical company and the largest chemical producer in the world. The quantum chemistry group at BASF is performing cutting edge research with several national and international collaborations. Her mentor, Dr. Sandip De is the Global Scientific Discipline lead and heads the Quantum Chemistry – Inorganics group at BASF-SE, Ludwigshafen.

With the advent of AI in different fields of science, conscious efforts have been focused in the direction on building structural databases that can then be harnessed with data-driven approaches for materials research. Virtual screening has been used to filter large databases to a smaller number based on the similarity principle.



Sheena during the research discussion

During the fellowship, she primarily worked on developing a tool to perform 3D structure and/or sub-structural search. For the same, they explored the use of multiple structural embeddings to encode the material environment. Accuracy of the performing model will crucially depend on the structural encodings used as input and having multiple encodings will give model the desired flexibility with respect to changing target applications. Several ML-based search strategies to perform search in the structural space with given embeddings were iterated. Performed benchmarking proved the efficiency of the developed method, in terms of time and accuracy, in comparison with the existing tools.

According to her, the fellowship is extremely enlightening and a great exposure on a lot of fronts. The fellowship program was the right kind of exposure for her as she intends to join industry after doctoral research. She got the opportunity to interact with collaborators and got to know about the cutting-edge research in the field that is going on internationally. The research work performed during the fellowship not only helped her to expand the horizon of her knowledge, but also gave her the opportunities to try venture into newer areas of research.

>HARISH PV

Modelling high entropy alloys for catalysis



Harish at BASF Lab, Ludwigshafen

Harish PVV, a PhD student at IIT Bombay, working under the guidance of Dr. Ankit Jain. His focus is on computational materials science, specifically lattice thermal conductivity and heterogenous catalysis using quantum mechanical and force field techniques.

As an IGSTC PhD Industrial Exposure Fellowship awardee, he had the opportunity to work at BASF Chemicals, the world's largest chemical producert in Germany with Dr. Sandip De. As part of the fellowship, he is working on generating force fields using machine learning and publicly available databases as well as modeling high entropy alloys using force fields for catalysis applications. They are using monte-carlo techniques to analyze the clusters formation, structure stability, and mean-field approximations to predict the catalytic activity on MoNbTaVW alloy for oxygen reduction.

As researcher, it has been a highly enriching experience to observe science and engineering at the production level, as it has given him a better understanding of the possibilities and limitations at different scales. It has also been exciting to learn about recent advancements in the field, work and interact with people from around the world, to explore Europe.

> YAMINI MITTAI

Wastewater treatment through constructed wetlands



Yamini with her colleagues at Janisch & Schulz

Yamini Mittal pursuing PhD in Engineering sciences at CSIR-IMMT, Bhubaneshwar primarily focuses on wastewater treatment. She had explored numerous aspects of a nature based sustainable wastewater treatment technology i.e., constructed wetlands (CWs) at lab scale.

Yamini started her fellowship in April 2022 for 6 months under PhD industrial Exposure Fellowship (PIEF) category of IGSTC Industrial Fellowship programme. She was hosted by Janisch & Schulz in Germany under the mentorship of Mr. Andre Schaeller. Janisch & Schulz in Germany focuses towards building constructed wetlands for cost-effective treatment of commercial and domestic wastewater, both in combined and separate sewer networks. They have a vast experience in designing and building CWs for municipalities, private operators and industrial wastewater with over more than 600 constructed CWs all over Germany.



Field work picture during construction of 6 people CW treatment facility in Oberwesel, Rhineland-Palatinate

After realizing the potential of constructed wetlands (CWs) towards wastewater treatment and management of rural, urban cities and communities, she learnt about field scale planning, designing and construction of CWs with Janisch & Schulz, Gambach, Germany. In her initial days, she learned the CAD designing of CWs along with gaining knowledge about difference in CWs design, operation and working in Germany. Later she acquired knowledge about the involvement of German administration in building and maintenance of CWs. She collected and analyzed treated samples and interacted with private and industrial CWs owners to know their experience of having CWs as

wastewater treatment plant. The main achievement through the fellowship was she got to independently handle on planning, designing and construction of 2 private CWs projects with treatment capacity of 40 people and 15 people.

Yamini had an amazing experience throughout the process starting from acquiring the projects to its completion. IGSTC fellowship has provided her an excellent opportunity to acquire hands on experience towards field scale CWs construction and it paves a path to advance her career, together with amazing experience of German culture and lifestyle.



Participants at the interactive session

Interaction with industrial fellows

An interactive session with IGSTC Industrial fellows of batch 2022 was organised on 28th December 2022. The session highlighted the goals of the fellowship, research ethics, networking and various other aspects, the fellows need need to take care during the fellowship.

A vibrant Q & A session made the event enjoyable and informative. IGSTC fellows shared their experiences during the fellowship on how it helped their research.

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Outreach of IGSTC

Coimbatore and Thiruvananthapuram

Virtual Outreach Event

International Conference on

"Natural science and green technologies for sustainable development"

IGSTC at various institutions

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> COIMBATORE AND THIRUVANANTHAPURAM



Participants at Coimbatore event on 26th September 2022



Panel discussion at Coimbatore event on 26th September 2022

IGSTC in its pursuit to enhance the visibility of the Centre conducts outreach events in various tier-2 cities of India. The first outreach event was held at Coimbatore, Tamil Nadu on the 26th September 2022. The second outreach event was held at Thiruvananthapuram, Kerala on 22nd November 2022. IGSTC invited several academic, research institutions and industries in the vicinity of both the cities for participation. More than 100 invitees from approximately 50 institutions participated in the events. The one-day interactive event included detailing of IGSTC activities, descriptive sessions for applications, presenting success stories, address from visiting dignitaries and a panel discussion. The panel discussion with panelists from academia, research, industry and German consulate on Relevance of International S & T co-operation in today's context and Connecting Industry, Academia & Research generated excellent response from the audience and was a great experience. The events were well received and much appreciated by the participants.



Participants at Thiruvananthapuran event on 22nd November 2022



Panel discussion at Thiruvananthapuram event on 22nd November 2022



> VIRTUAL OUTREACH EVENT



IGSTC Virtual Outreach Event, 27th October 2022

IGSTC German project office organised a Virtual Outreach Event on 27th October 2022 to publicise IGSTC programmes to a larger audience in Germany. Mr Madhan, Director, IGSTC welcomed all the participants and gave a brief introduction on IGSTC. Dr Ulrike Wolters, BMBF congratulated IGSTC for acting as the nerve centre for Indo-German S&T Cooperation. Dr Madhusudan Reddy Nandineni, Science Counsellor, Embassy of India, Berlin congratulated India & Germany for completing 70 years of diplomatic relations and encouraged researchers, academicians & industrialists to initiate cooperation in the priority areas

of Green and Sustainable technology, Renewable energy and Agroeconomic as discussed in the Intergovernmental Consultations (IGC) held in Berlin, May 2022. The event also witnessed success stories from 2+2 project: PPAM and Indo-German workshop on sustainable stress management: aquatic plants vs. terrestrial plants, followed by the introduction of the newly launched IGSTC programmes: WISER, PECFAR and SING by Ms Doerte Merk, German Project Office, IGSTC. The event was well attended by representatives from scientific community in India & Germany.

> INTERNATIONAL CONFERENCE ON

"Natural science and green technologies for sustainable development"



Dr. Lalitha's talk on IGSTC programmes

IGSTC participated at the International Conference on "Natural science and green technologies for sustainable development" scheduled to be held from 30th November 2022 - 2nd December 2022 at Goa. The Conference has been organised by School of Biological Science & Biotechnology, Goa University in association with the National Environmental Science Academy (NESA), New Delhi. The Conference had nearly 300 participants from the scientific community. A presentation on IGSTC programmes was delivered by Dr. P.V.Lalitha, Chief Scientific Officer for the audience. IGSTC also had a display booth highlighting different programmes.

> IGSTC AT VARIOUS INSTITUTIONS

Through its various programmes, IGSTC has been supporting several research/academic institutions and industries from India and Germany to catalyse Indo-German strategic **R&D** partnerships. IGSTC regularly engages with various stakeholders like Universities, Research Institutions, Industries and Government agencies to promote IGSTC programmes. IGSTC has organised and participated in various outreach events. The outreach intends to make programmes offered by IGSTC, more visible and accessible to the larger number of universities/institutions in India and Germany. It diversifies the pan-India and Germany presence of IGSTC and creates an impetus to increase the participation of scientists, industrialists, women researchers, young researchers and engineers representing several institutes in STEM.





Session at IISER Pune









Project visit at IACS, Kolkatta





Meeting at CSIR-IMMT, Bhubaneshwar



Project site at Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani





Talk at CSIR-CSMCRI, Bhavnagar

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