IGSTC

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INSIDE

Editorial Team

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IGSTC: Recent Activities

IGSTC launched new programmes and initiatives this year to accelerate the scientific activities between India & Germany. IGSTC's 2+2 projects are at various stages of implementation and several success stories and technology developments are being resulted out of them.

The 6th Finance Committee meeting and 12th Governing Body meeting of IGSTC were held on 5th & 27th October respectively. Meetings were focussed on the financials, scientific programmes and future directions for IGSTC.

Chembiosens, a start-up spun out of Biosensors Laboratory, IIT Madras received a seed funding from StartupTN, a Tamil Nadu Government's initiative to promote start-ups in the state. The start-up focus has its foundation in the Multi-WAP project funded by IGSTC and IIT Madras as its Indian academic partner.

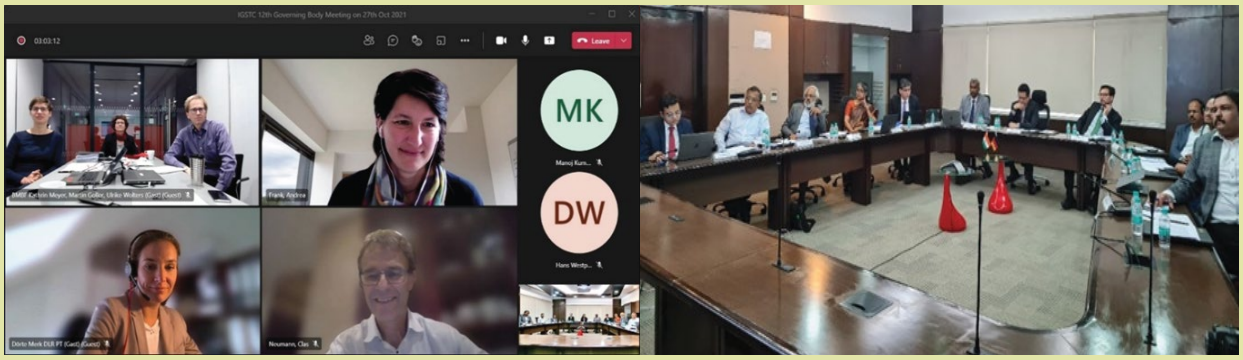
IGSTC organised a pivotal workshop in Artificial Intelligence on behalf of the German Federal Ministry of Education and Research (BMBF) and the Department of Science and Technology (DST) of Ministry of Science and Technology, India on 6-7 September. The workshop brought together key scientists from India & Germany in academia and industry to strengthen the Indo-German collaboration in AI. The workshop resulted discussions in key topics such as AI for sustainability, Healthcare, Autonomous Robotics, Trustworthy AI and Mathematical Foundation and directions for future collaborations in R&D between Indian & German research community.

IGSTC Industrial Fellowship programme for Indian PhDs and Post-docs was launched by the then Secretary, DST, Prof. Ashutosh Sharma on 14th June 2021. The Fellowship aimed towards young Indian researchers to gain exposure at an Industrial setup in Germany. The Call received tremendous response, and 20 applicants were selected for this prestigious Fellowship. A brief profile on each of the Fellows is highlighted in the newsletter in the following pages.

Women Involvement in Science and Engineering Research (WISER), a first-of-its-kind programme to promote women in the field of research and development through lateral entry was launched on 24th November 2021 for encouraging women researchers in joint R&D projects in India & Germany. The programme was launched by eminent women scientists from India & Germany Dr. Tessy Thomas, Defence Research and Development Organisation, Ms. Muthayya Vanitha, Indian Space Research Organization, Prof. Petra Lucht, TU Berlin and & Prof. Nicola Marsden, Hochschule Heilbronn. The programme will enable women scientists in both the countries to cross-fertilise their scientific ideas and enable long-term Indo-German connect.

The flagship programme of IGSTC i.e., 2+2 Project Scheme will launch a call in the new year on Waste to Wealth and Sustainable Packaging. A new Fellowship for early career researchers in India & Germany will also be launched in early 2022. IGSTC programmes in industrial R&D, Fellowships, bilateral workshops, etc will enhance the collaboration in STEM between India & Germany in near future.

Governing Body & Finance Committee Meetings



12th Governing body (GB) meeting – 27th October 2021

The 12th Governing Body (GB) meeting of IGSTC was held on 27th October 2021 through virtual mode. The GB members are Mr. S. K. Varshney (DST & Indian Co-Chair), Ms. Kathrin Meyer (BMBF & German Co-Chair), Mr. Vishvajit Sahay (DST), Prof. Sandeep Verma (SERB), Ms. Andrea Frank (Stifterverband), Dr. Tata Narasinga Rao (ARCI), Dr. Martin Goller (BMBF), Mr. Philipp Ritter (German Embassy, New Delhi), Mr. Sanjeev Rangrass (ITC), Dr. Clas Neumann (SAP). Dr. Ulrike Wolters (BMBF), and Dr. Sibashisa Das (DST) are member secretaries. Mr. R. Madhan (Director), Dr. P V Lalitha, Mr. R Varadarajan, Mr. Hans Westphal and Ms. Doerte Merk (DLR-PT) represented IGSTC in the meeting. The GB focused holistically on IGSTC's 2+2 flagship programme, thematic areas for future grant calls and new programmes to be taken up etc.

6th Finance committee (FC) meeting – 5th October 2021

The 6th Finance Committee (FC) meeting took place on 5th October 2021 through virtual mode. The FC comprises of Mr. Vishvajit Sahay (Financial Advisor, DST and Indian Co-Chair of FC), Dr. Ulrike Wolters (BMBF), Dr. Martin Goller (BMBF) and Dr. Sibashisa Das (DST). Mr. R. Madhan (Director, IGSTC), Mr. R Varadarajan (Manager, IGSTC), Mr. Pravin Gupta (Financial consultant), Mr. Hans Westphal (DLR-PT/IGSTC) attended the meeting for IGSTC. Discussions held and decisions taken on financials, audit report and budget estimates for IGSTC.

2+2 Projects

DEMO-MULTI-WAP

Demonstration of Multi-WAP results leading to novel, validated multiplexed, label-free fiberoptic biosensor array system for waterborne pathogen detection

Project Investigators

V V Raghavendra Sai
IIT Madras, Chennai

V Sandhya Sowjanya
ChemBioSens Pvt Ltd
Chennai

Claus-Peter Klages
TU Braunschweig
Braunschweig

Vitaly Raev
TU Braunschweig
Braunschweig

Mahavir Singh
Lionex GmbH
Braunschweig

The aim of DEMO-Multi-WAP is to bring to the market a device and ready-to-use test kits ('plug & play' cartridges) for waterborne pathogens detection. The platform is a multiplexed, rapid, label-free and real-time method for continuous monitoring multiple waterborne pathogens present in water samples at low cost and high sensitivity (→90%). Project aims to realize this by building upon a highly sensitive array sensor system concept which has been validated for different biomarkers.

ChemBioSens Pvt Ltd secured a seed grant from StartupTN for TB diagnostics for Tamil Nadu, Startup Seed Grant Fund (TANSEED) funding.

ChemBioSens Pvt. Ltd. is the Indian industry partner in the Demo-Multi-WAP project to co-develop the fiber optic sensing technology for multiplexed detection of waterborne pathogens along with IIT Madras, TU Braunschweig and Lionex Diagnostics and Therapeutics GmbH. It is a

Hon'ble Chief Minister of Tamilnadu M. K. Stalin felicitating the ChemBioSens team

start-up spun out of the Biosensors Laboratory at IIT Madras in October 2018. It has its genesis in the execution of Multi-WAP project by IIT Madras funded by IGSTC.

ChemBioSens mainly focuses on the translation of chemical and bio sensing technologies for applications in various fields including clinical diagnosis, water and environmental monitoring, food safety, pharma and chemical industry. ChemBioSens is one among the 19 startups that have been selected for seed grant worth INR 10 Lakhs from StartupTN, a Tamilnadu Government's initiative to promote startups in the state. This grant will help ChemBioSens towards development of a highly sensitive point-of-care device for detection of Tuberculosis (TB) biomarkers in urine. Such tests have the potential to enable simpler and rapid TB screening tests for subjects suspected of pulmonary and extrapulmonary TB at primary healthcare centres and help in early identification of active TB infection, treatment and disease control.

DEMO-Multi-WAP project team members at the partner meeting online.

The Annual meeting of partners involved in the 2+2 project was held virtually on September 23, 2021. The meeting was focused on presentation and discussion on progress and plans for the upcoming months of all work packages.

Apart from the virtual meetings mentioned above, there is intense communication between different partners working on the project. The next project meeting will be organized by Institut für Oberflächentechnik (IOT), Technische Universität Braunschweig in Germany.

Sensvert

Development and evaluation of automated sensors for a highly-efficient nutrition management system in Indoor vertical farming

Project Investigators

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Shivendra Singh
Barton Breeze
Gurgaon

Heike Mempel
Hochschule Weihenstephan
Triesdorf, Freising

Mohamed Bourouah
Hahn-Schickard
Schwenningen

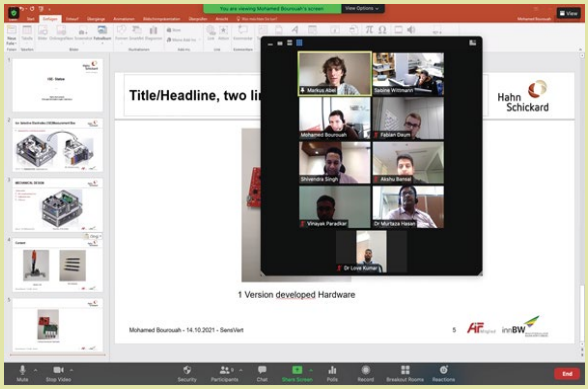
Georg Brückner
Sondermaschinenbau
Brückner GmbH, Marktgraitz

The importance of vertical farming systems to produce foods like leafy greens, herbs or vegetables is increasing worldwide. Vertical farming means a highly efficient crop production that maximizes the obtainable yield per cultivation area. By using multiple levels, supplied with artificial LED lighting and completely isolated cultivation conditions, a very precise and controlled crop cultivation is possible year-round. Next to the climatic conditions, the availability of nutrients, by a meticulously monitored and continuously customized nutrient solution on a single ion level will be crucial for an optimal and closely controlled plant cultivation with a high product quality. On the other hand, the use of simple sensors for EC and pH to serve as fertigation management is still predominant in horticultural companies equipped with hydroponic systems worldwide. Therefore, the main objective of the research approach is the development of an automated sensor system for a highly efficient nutrient management system in vertical farms. The addition of specific ions into the nutrient solution will be based on the rate of withdrawal by the roots and plant specific needs.

SensVert project, which held its kick-off meeting on the 02-08-2021 is heading towards the first applied tests of the ion selective electrode (ISE) array, designed for continuous monitoring of the mean ions in hydroponic nutrient solutions. While the ISE array developed at Hahn-Schickard Institute in Germany is currently undergoing laboratory tests, before being delivered to Hochschule Weihenstephan Treisdorf (HSWT) and the Indian Council for Agricultural Research (ICAR) for test runs with respective hydroponic test units, the target ion species and concentration ranges were determined through ICAR and HSWT. Those were discussed and shared at two meetings of the project partners in October and December together with the desired specifications of the sensor array and the hydroponic test units required to apply the sensor array on nutrient solutions and to conduct further experiments with the ultimate objective of real time adjustments of the concentrations of individual ions in the nutrient solution based on the measurements of the ISE array.

The test unit at HSWT used for the development of a prototype of an ion selective nutrient management system is built by the German company Brueckner Spezialmaschinenbau in

close exchange with the other partners. The Indian company Barton Breeze, which specializes in automatization of hydroponic farms, is involved from an early stage at the integration of the sensor array in the hydroponic production unit and will develop the final user interface.



Zoom-Meeting of the Project Partners in October: Mr. Bourouah of Hahn Schickard Institute is Presenting the Progress of the Sensor Platform Development.

Investigated growth response of lettuce crop grown under multiple LED light system

The study is being conducted at the Centre for Protected Cultivation and Technology (CPCT), ICAR-Indian Agricultural Research Institute (IARI), New Delhi. The aim of the study is to determine optimal photoperiod for lettuce grown in the vertical hydroponic system with artificial lights. The observations such as transpiration rate, stomatal conductance, intercellular CO2 concentration etc. are being recorded. Lettuce is grown under full spectrum Light-Emitting Diode (LED) lights. Different photoperiod treatments with replications are being undertaken. Another experiment is being conducted to determine optimal quality of light to grow lettuce plants in vertical farming with artificial lights. In this experiment, the effect of various Red: Blue ratios on growth and yield of lettuce are to be studied. The comparison of results of both these experiments will also be done with vertical hydroponic system without artificial lights

Lettuce crop grown under multiple LED light system

CANDECT

Cluster-composite nanofiber membranes for rapid, ultra-trace detection of waterborne contaminants

Project Investigators

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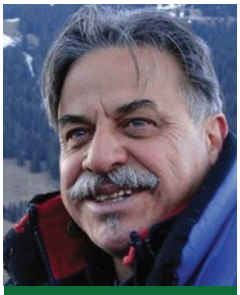


Hansjörg Fader
Fader Umwelttechnik (FAD)
Karlsruhe

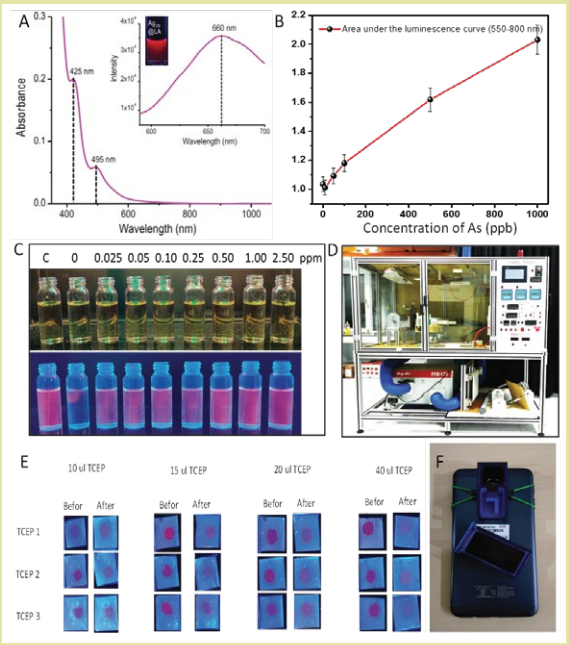
Elevated arsenic (As) concentrations in water are faced by about 200 million people worldwide and has become one of the biggest challenges in the context of water purification. Long-term exposure to arsenic from drinking-water and food can cause cancer and skin lesions. Contamination of drinking water by As is one of the major concerns for India as well as Germany. Prevention of further exposure to arsenic by the provision of safe water supply for drinking, food preparation and irrigation of crops to the affected communities is important. Monitoring of As contaminated water is an important aspect in the implementation of arsenic removal technologies in the affected areas. Consortium of IIT Madras (IITM), Inno Nano Research Pvt Ltd (INR), Karlsruhe Institute of Technology (KIT)and Fader Umwelttechnik (FAD) are working towards a solution in the form of affordable technology which can be implemented in the form of luminescence based arsenic sensor system with atomically precise quantum nanoclusters.

Nano clusters consist of a well-defined metal core which is protected by ligand shells such as thiols, phosphines, etc. Some of the metal nano clusters (like gold (Au), silver (Ag) and so on) are known to be luminescent in nature. But their applicability in the field of sensors is often limited due to their instability in various conditions. After numerous trial and error attempts with many cluster systems, a system of Lipoic acid (LA) protected Ag clusters used with Tris(2-carboxyethyl) phosphine (TCEP) has been demonstrated for sensing arsenic at sub ppm concentrations and the team is working on further improvement in the sensor performance. The current cluster in use, is an atomically precise (Ag29@LA), water soluble and red luminescent nano-entity, whose properties have been already studied and published recently by the IITM research group. (Esma Khatun et al., J. Chem. Sci., 2018, 130, 147) The methodology has been developed for a wide range of concentration and kinetics. The interaction between the analyte and the sensing system is studied by NMR spectroscopy and fluorescence lifetime measurements. The effect of the role of the interfering ions (various cations and anions) present in field water on the sensor performance has been checked and a methodology for the elimination of cations is evolved. Ag29(LA)1

2 – TCEP sensor system has been developed in the solution phase which shows OFF-ON luminescence response depending on As concentration in water. For solid state sensing, the cluster immobilized electrospun fiber mats have been developed which are luminescent in nature and have been tested for As.

Patent filed: A luminescence-based method of detecting arsenic using atomically precise noble metal nanocluster and phosphine, Thalappil Pradeep; Sritama Mukherjee, Application no. 202141038227, dated August 24, 2021.

INR has evaluated the available designs for luminescence-based sensing using mobile attachment and the necessary approach for its implementation in the present project has been identified. INR has developed a backbone of the device for smartphone-based readout of this sensor which can be used for precise measurement of arsenic in contaminated water. Apart from that, water samples from various sites in West Bengal, India were collected and analyzed using ICPMS to know the current level of arsenic contamination. Effort is given in integration of luminescence-based sensor system with an electronic monitoring device connected to smartphone for developing a cost effective and easy to use product.



A. The UV–Vis spectrum of Ag29(L)12 with maximum at 425 nm and inset shows optical image under UV light and emission at 660 nm. B. Linear response of Ag29(L)12–TCEP system to As(III) at sub ppm concentrations. C. Optical image of Ag29(L)12–TCEP system to As(III/V) at ppb level concentrations under visible and UV light. D. Multinozzle ESPIN Nano Model- V2 electrospinning machine purchased and installed in IIT Madras. E. Optimization experiments for the solid state arsenic sensing tests with the cluster immobilized electrospun fiber mats. F. Design of the sensor holder developed by INR.

PYRaSOL

Smart Cities Integrated Energy Supply, Carbon Sequestration and Urban Organic Waste Treatment through Combined Solar Sludge Drying and Pyrolysis

Project Investigators

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Biomacon GmbH
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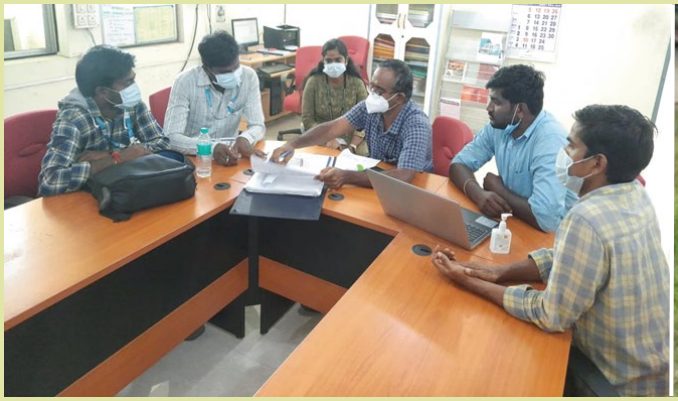
The main objective of the project is to generate thermal energy and biochar from the organic fractions of municipal solid waste especially fibrous organic material which is not suitable for anaerobic digestion (banana peduncle) and sewage sludge from sewage treatment plant generated from Urban cities using accelerated solar drying system and single chamber pyrolysis. Under this project, installation of pilot plant consisting of solar drying system by Indian industrial partner and pyrolysis system by German industrial partner are proposed at CSIR-CLRI, Chennai.

Site visit and meeting with Indian Industrial Partner on 14.09.2021

Engineers from Indian industrial partner M/s. Ramky Enviro Engineers Ltd have visited the proposed pilot plant site at CLRI to get the existing site conditions in order to finalize the design and drawings for the construction of Solar dryer. Dr. S.V. Srinivasan and his team have discussed with them about the existing site and soil conditions for the construction of solar dryer.



Mr. R. Madhan, Director, IGSTC visited CLRI on 29.09.2021 to review the ongoing PYRaSOL project and recently completed RESRVES project under 2+2 scheme. He had discussion with Director, CLRI and made presentation to scientists and students about activities & funding opportunities available in IGSTC to researchers and upcoming programs for women. He has visited the existing R&D biogas pilot plant installed under RESERVES project and the pilot pyrolysis plant sent by German partner which is being installed under PYRaSOL project. Based on the visit and observations, a short meeting was held with Dr. S.V. Srinivasan, Senior Principal Scientist and Shri. R. Suthanthararajan, Chief Scientist & Head, Environmental Engineering Department regarding future plan of the projects and effective utilization of the pilot plants.

Visit of Mr. Madhan, Director IGSTC to Pilot plants at CLRI

Meeting with German and Industrial Partners on 22.10.2021

A virtual meeting was held to finalize the drawings of solar dryer with chimney effect. In this meeting, Dr. Dirk Weichgrebe, Project Investigator with his team from German side interacted with Indian partners Dr. S.V. Srinivasan, Senior Principal Scientist, CSIR – CLRI with his team and Mr. Kotina Santhosh Kumar, Deputy General Manager, Ramky Enviro Engineers and his team. In the meeting, inputs were given to M/s. Ramky for the finalization of drawings submitted on solar dryer and arrangement of the chimney above the solar dryer with additional support. In addition, a short discussion was also held in the design of mixing system required for the mixing of the fibrous organic waste and sewage sludge inside the solar dryer.

CLRI team have also explained about the status of installation of the pilot pyrolysis unit and timeline for the supply, installation and commissioning of pre-treatment and monitoring equipment was also discussed.

Meeting with German and Indian Industrial Partners.

MIDARDI-D2P

Microfluidic based detection of microbial communities and antibiotic responses in the management of diabetic foot ulcers – demonstrator to prototype

Project Investigators

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Dr. Harald Peter
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Potsdam-Golm

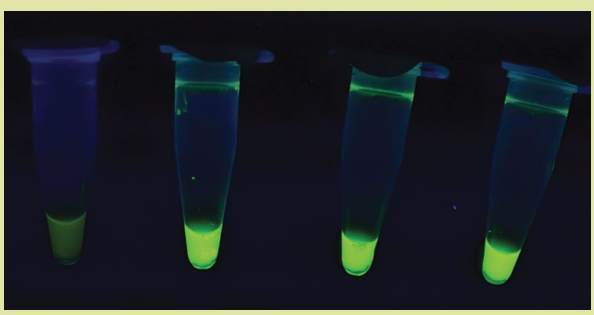
Joerg Nestler
BiFlow Systems GmbH
Chemnitz

Project Summary

Diabetic Foot Ulcers (DFU) are often associated with type 2 diabetes and therefore still being an increasing issue both in Europe and India. Though infected ulcers require proper antibiotic therapy, rapid and accurate detection of polymicrobial communities in the wound environment are critical in proper wound management. Current lab-based methods require two or more days for such a test.

The MIDARDI consortium has been developing a microfluidic-based lab-on-a-chip for rapid (←1 hour) and accurate detection of different types of bacteria, their virulence/fitness factors, and antibiotic resistant genes that may contribute to the dominance of certain types in DFU settings. The detection module (instrument) will aid clinicians in the decision-making process to improve specific outcomes that would concomitantly improve wound healing per se in DFU scenario. Further, it would provide a better understanding of the underlying microbial communities to develop treatment regimens to suit responses to individuals' lifestyle modifications.

In the MIDARDI-D2P project during the period September to December 2021, substantial amount of work was carried out. Earlier, the microarray layout was standardized by the German collaborators and several probes in the layout were validated with clinical samples. The microfluidic lab-on-a-chip was also tested with different samples for its robustness and accuracy. Amplification methods were standardized from clinical samples using glass microarray panels sent by the German partners. Results clearly highlighted the absence of cross-hybrdization reactions for different bacterial samples. Sample input methods were also standardized to improve the turn-over time and amplification protocols were modified to suit the needs of the expected samples. The portable reader developed by Achira Labs was tested for its compatability to interface with microfluidic cartridges. Similarly, the fluorescence based detection system has also been tested against bacterial samples.



Detection of amplified products using fluorescence. Tube 1 is control and tubes 2-4 are amplified products.

PPAM

Metal powder production for additive manufacturing

Project Investigators

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Suman Chakraborty
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Suvankar Ganguly
Tata Steel Ltd.

Cameron Tropea
TU Darmstadt

Hans-Jürgen Odenthal
SMS group GmbH

Project Summary

For manufacturing of objects using Laser Powder Bed Fusion (LPBF), a fine metal powder is solidified in layers using a focused laser beam. The properties of the product depend strongly on the uniformity of size and consistency of the powder particles. This project addresses the production of steel powder for LPBF using close-coupled atomization and strives to better understand and model the process to achieve a uniform size and porosity of the powder particles. Generic experiments, numerical simulations and pilot plant operation are used in combination to develop validated, predictive capabilities and design guidelines for full-scale facilities. Scientifically, the challenge lies in modelling the complex liquid metal atomization involving extreme process conditions and material properties. The results will be of immediate competitive benefit to the collaborating companies, one as a manufacturer of such powder production facilities and one as an end-user. Improved quality, cost effective and an expanded product design parameter space can be expected.

Modelling of droplet-shock interaction: a comparison with experiments, Kaustav Pradhan, Somnath Santra and Suman Chakraborty, Department of Mechanical Engineering, Indian Institute of Technology Kharagpur

This work is a part of the IGSTC project titled Metal Powder Production in Additive Manufacturing

2D simulations of droplet-shock interaction: The team have carried out a model validation study between the numerical results and the experimental results performed at IISc Bangalore and have qualitatively validated numerical calculations with the experiments of Sharma et al. (2021).

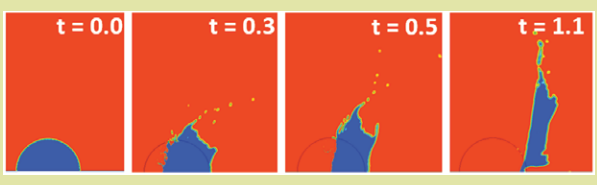

Figure 1. Drop breakup features seen in case of a 2D simulation for a moderate value of Weber number

The numerical simulations for the same diameter drop show a similar muffin-like shape appearing at an intermediate stage (t = 0.3 ms) as reported in the experiments shown in figure 1. For moderate values of Weber number, during the interaction of the droplet with shock wave, a high-pressure region is formed near the front stagnation point due to flow stagnation and at the rear stagnation point due to Machwave focusing and recirculating jet flow results in the deformation of the droplet into a muffin-like shape.

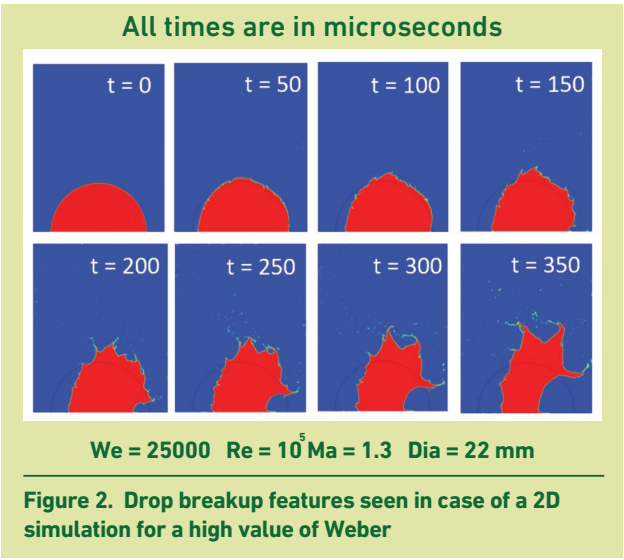

Figure 2. Drop breakup features seen in case of a 2D simulation for a high value of Weber

For higher Weber number, K-H instabilities are initiated near the pole on the windward side which travel towards the equator and form ligaments. The rupture of these ligaments due to the high shear gives rise to the ultimate shear-induced breakup of the drop at the high value of Weber number.

3D simulations of droplet-shock interaction: To consider the effect of third dimension of the domain in the analysis and incorporate the 3D nature of the flow field in the analysis, 3D numerical simulations have been performed and compared the results with Sharma et al. (2021) as shown in figure 3. The figure shows excellent matching between the numerical and the experimental results of Sharma et al. (2021).

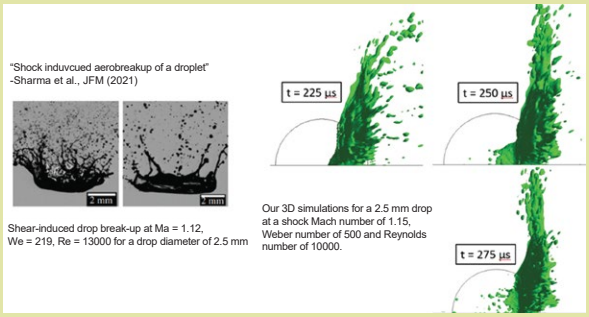

Figure 3. Comparison between numerical and experimental results.

Figure 4 shows how the drop initially deforms into a flat shape before getting ruptured. It has been observed that the drop break-up phenomenon spans over approximately 400 microseconds (with the time being calculated from the instant the incident normal shock wave interacts with the drop). Further studies are in progress to improve the tracking of the air-water interface so as to capture the break-up details with even more clarity.

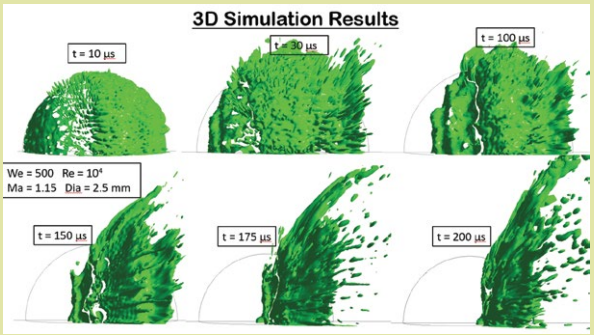

Figure 4. Drop breakup features seen in case of a 3D simulation for a high value of Weber

NearNetMac

Design and development of near-net-shape manufacturing process for light weight high strength Aluminium composite and engineering components by squeeze infiltration technique for automotive and aerospace applications

Project Investigators

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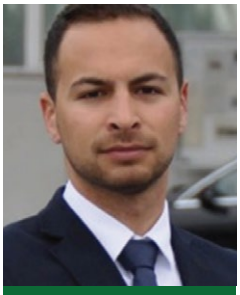
CSIR- NIIST
Trivandrum

H. Sundaramurthy
Fenfe Metallurgicals
Bangalore

Thomas Gries
RWTH Aachen University
Aachen



Farbod Nezami
CIKONI GmbH
Stuttgart

The increased demand for lightweight materials with high specific strength, stiffness and better tribological properties have accelerated the development, diversification and use of metal-matrix composites (MMCs). The objectives of the present investigation are development of processing method for Carbon (C) fibre reinforced Aluminium (Al) MMCs by liquid metal infiltration process. Preforms of high modulus continuous C-fibre will be produced by advanced textile technologies like 3D-weaving in a near-net shape form based on the expertise of ITA RWTH Aachen University, and the squeeze infiltration processing of Aluminium composite will be carried out in the CSIR-NIIST. The Indian Industrial partner, Fenfe Metallurgicals will develop and supply the suitable Al-alloy for the infiltration and industrial scale processing and evaluation of connecting rod and heat sink components. The German industrial partner, CIKONI GmbH will provide the conceptual and detailed part design based on the textile and infiltration process as well as the structural analysis. The developed near-net-shape component will be evaluated and on successful development the industrial partners will manufacture the components for Indian and German OEMs.

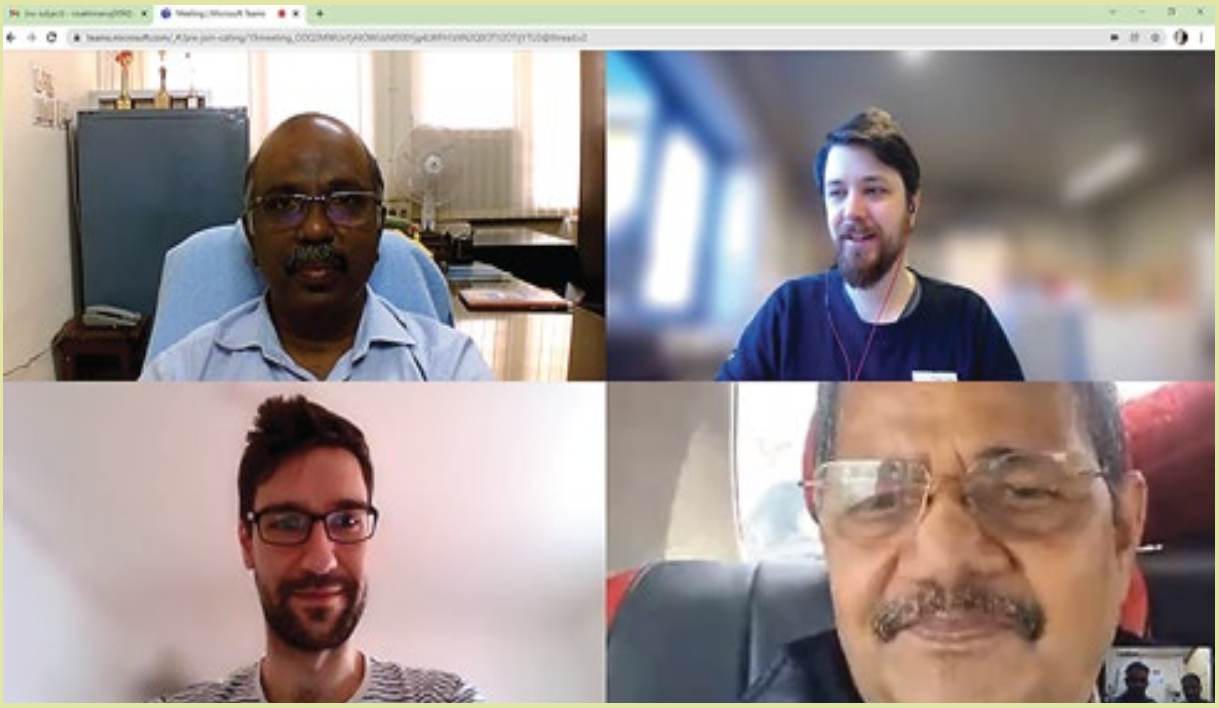
First prototype production as a successful quality gate

In December, the first successful prototype has been produced in the ongoing IGSTC project NearNetMac. The prototype that has now been produced, a connecting rod for a single-piston motorbike, is an important element for the

Connecting rods manufactured in igstc project nearnetmac; pure a356 al-alloy (upper part); t700 carbon fibre reinforced a356 al-alloy (lower part)

technical and economic evaluation of the developed composite materials and therefore a crucial quality gate in the project. In addition to the carbon-fibre-reinforced connection rod, a reference component was manufactured with the same alloy but without fibre reinforcement (see below figure) which enables/allows a direct comparison. Initial technical investigations show advantageous properties, such as a doubled brinell hardness.

In addition to the techno-economic evaluation, the manufacturing serves to synchronise the individual developments of the partners, which converge in this step. Therefore, several bilateral meetings with the entire consortium were held in preparation for the prototype production.



Project meetings to synchronise project results in the course of the prototype production. (Dr. T.P.D. Rajan, CSIR-NIIST; Mr. Philipp Huber, Ita-Rwth, Mr. David migacs, cikoni and Dr. H. Sundaramurthy, fenfe metallurgicals)

The final steps of the project are comprehensive physical and mechanical characterisation of the manufactured components, the production of a connecting rod with 3D woven reinforcement and the application to another prototype. If successfully implemented, the utlimate outcome step will be to draw up a plan for the commercialisation of the various elements of this project.

HERCET

Development and validation of a cost-effective hybrid electric drive solution for small two wheelers for reducing CO_2 emission

Project Investigators

A Ramesh
IIT Madras (IITM)

S J Dhinagar
TVS Motor Company Hosur (TVSM)

Jakob Andert
RWTH Aachen University Aachen (RWTH)

Lars Posdena
VEMAC GmbH & Co KG Aachen (VEMAC)

The objective of this project is to develop a cost-effective hybrid two-wheeler fulfilling the requirements of reduced CO_2 and other emissions and improved fuel economy. IIT Madras and RWTH Aachen will develop and integrate 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. The proposed hybrid control strategies will be experimentally evaluated and fine-tuned in the laboratory in IIT Madras on a special test rig. Integration on the two-wheeler, calibration for performance and evaluation on the test bench and outdoor test track will also be done by TVS Motors. One prototype vehicle will be evaluated in Germany for fine tuning the control logic. Finally, the potential for reduction of fuel consumption and CO_2 emissions will be evaluated against a targeted value of 25% in the chassis dynamometer in TVS Motors.

Vehicle testing at TVS Motors

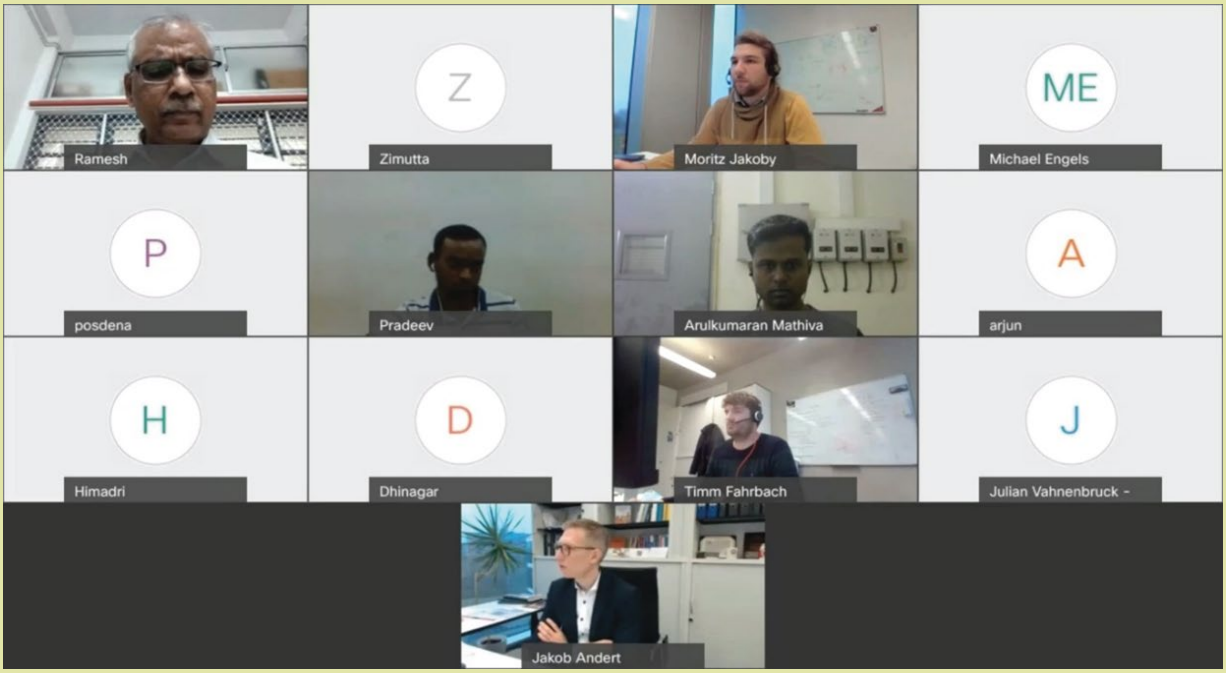
The team from IIT Madras conducted vehicle level tests at TVSM Hosur on the 9th and 10th of October

Team of TVS Motors and IIT Madras at TVSM Hosur for vehicle testing

2021 with the cooperation of engineers from TVSM. The preparations were started on the 7th of October 2021 in TVSM. Various components required for tests including fabricated ones were taken from IITM to TVSM so that the experiments can be conducted within short time frame at TVSM. The setup preparation was completed in 2 days with great support from engineers from TVSM. Vehicle testing on the chassis dynamometer was done on 9th and 10th of October 2021. Special instrumentation was done to measure the speed of the Continuously Variable Transmission (CVT) and the clutch input and output shafts on the powertrain. This test data is vital to characterize engine performance, emissions and CVT behaviour for validating the model.

Joint progress meeting of the Consortium

Representatives from RWTH Aachen, TVS Motors India, VEMAC Germany and IIT Madras had a 120-minute discussion on the 17th of December 2021. This is one of the several meetings that are conducted between the team members periodically. This meeting started with IITM presenting their experimental results, engine and CVT models and the validation of the models with experimental data. The models have been handed over to RWTH for evaluation of different hybrid topologies. Later, RWTH presented their work on a similar hybrid powertrain project which has many things in common with HERCET project. Then, VEMAC gave an update on their progress. They have improved the capability of their ECU which will help us to easily integrate with the hybrid powertrain. This improvement includes both software and hardware upgradations. This was followed by general discussion on selection of battery, motor and HIL simulation hardware, etc.



Virtual meeting with all project partners on 17th December 2021

RWTH Aachen team testing the hybrid powertrain

The team in Aachen worked on the first prototype of an innovative hybrid powertrain comprising a planetary gear set. The test drives worked well, and results are satisfactory. However, there is still room for improvement and optimization, which will be tackled within the remaining project duration.

IDC-Water

Integrated diagnostics of contaminants in water supply and management system

Project Investigators

Debiprosad Roy Mahapatra
IISc Bangalore

J Manjula
Bigtec Labs Pvt. Ltd. Bangalore

Rudolf J. Schneider
BAM, Berlin

Michael Voetz
Sifin diagnostics GmbH Berlin

In India, water-related diseases account for around 80% of premature deaths. Less than 50% of the population in India has access to safe drinking water. The most widespread health risk associated with drinking water is microbial contamination. The organisms causing water contamination are many, out of which E. coli, Salmonella, and Shigella are of primary interest for their detection and monitoring. Pharmaceutical residues in drinking water are another new aspects of testing technology development. Specific residues for the detection tests are amoxicillin and diclofenac. The project aims to develop a system for monitoring bacteria and pharmaceutical residues. It comprises an in-line system for remote monitoring and a portable micro-PCR-based device for detailed analysis in mobile or test laboratory settings.

Project activities

Project partners are meeting monthly online. In the meeting held on 7th January 2022, the partners discussed critical product prototypes and assay test results. Indian industry partner BigTec has been testing a preliminary prototype of tube-format RT-PCR. IISc is developing ways to conduct automated water quality tests for chemical and bacterial cell count, including low-cost maintenance and fewer reagents, consumable handling, and contamination-free tests. BAM and sifin have set up a laboratory semi-automated immunoassay testing, antibody supply, and related performance improvements to go into the proposed integrated prototype eventually. Target specification for detecting the pathogen would be less than 100 cells in one CFU/mL and for nano-molar concentration of target DNA detection is within an hour. Target standards for detecting pharmaceuticals will be 100 ng/L in 10 min.

Cell/DNA cartridge hardware prototype undergoing open board-level testing.

CO_2BioFeed

CO_2 and Biomass as feedstock for the production of energy carriers and chemical intermediates

Project Investigators

Asim Bhaumik
Indian Association for the Cultivation of Science Kolkata (IACS)

Biswajit Chowdhury
IIT (ISM) Dhanbad

Praveen K Chinthala
Reliance Industries Ltd. (RIL) Jamnagar

Thomas Ernst Müller
Ruhr-Universität, Bochum (RUB)

Jens Hannes
RWE Power, Aktiengesellschaft (RWE) Essen

Gernot Nell
Parr Instrument GmbH Frankfurt

In this 2+2 project, a consortium of academic and industry partners from India and Germany is working on the utilization of CO2 and biomass as renewable carbon feedstock for the production of energy carriers and industrially relevant high value chemical intermediates. Key to the new process is the optimized use of CO2 as basic building block and as coupling and soft oxidation agent. Olefins constitute the central platform

Joint project meetings

The consortium had a virtual project review meeting on 29th September 2021.

This meeting was dedicated to the overall status of the project, new proposals and selections of target reactions and reports from the Indian partners on catalyst synthesis and tests. The Indian colleagues at Indian Association for the Cultivation of Science, Kolkata, IIT (ISM) Dhanbad introduced some new innovative catalyst systems based on their amine surface-modified SBA-15 mesoporous materials and TUD-1 materials. After lively discussions, the Indian partners agreed on synthesizing new metal-nanoparticle-modified SBA-15 systems for testing at RUB.

RUB reported on the residence time behavior of the Berty-Reactor and the Fixed-Bed Reactor that are available for the project and on interesting results on the characterization and catalytic performance of the Chromium-MOF catalyst

received from the Indian partners. Lastly, some considerations were discussed concerning the safety concept for epoxidation reactions.

A second virtual group meeting was held on 1st of December 2021 along with the catalyst developing and testing members of the Indian and RUB partners to discuss primary results of the newly developed and synthesized iron and silver nanoparticle modified SBA-15 catalysts and Indium modified TUD-1 catalyst sent to RUB by the Indian partners.

F2F project meeting between RIL-IACS was held on 16th December 2021 at IACS Kolkata (Figure. below). The challenges in epoxidation and carboxylation reactions, catalyst preparation and methodologies were discussed. The background and possible mechanistic pathways of the prepared catalysts in the desired reactions were also discussed. Various mixed metal oxide and supported metal oxide catalysts were prepared by RIL and handed over for evaluation.

F2F meeting at IACS Kolkata (left to right, Sayantan Chongdar, Prof. Asim Bhaumik, Dr. Praveen Kumar Chinthala, Dr. Unnikrishnan P and Debabrata Chakraborty)

Complementary bilateral meetings between RUB-RWE and Parr-RUB have taken place (offline and online) to coordinate safe operation of the plants, nurture the mutual understanding and accelerate the progress of CO2BioFeed including a RWE plant and research center visit of the RUB CSC group to Niederaußem near Cologne, Germany.

Process development

RIL is setting up an online GC Integrated Reactor for Lab/Semi Pilot Testing. RIL's high pressure fixed bed reactor will be available soon for performance evaluation once the installation activities are completed (Figure below).

RIL`s Gas Reactor set up (to be integrated with GC)

At IIT (ISM) Dhanbad, a high pressure and high temperature online autoclave reactor has been procured, installed and trial reactions are in progress to check safety issues (Figure below). Online GC-MS has been delivered. Installation had to be deferred due to the ongoing pandemic.

Online high pressure and high temperature autoclave reactor at IIT (ISM) Dhanbad

RUB obtained new catalyst materials and started first tests in advanced reactors that have been constructed and obtained from Parr Instrument GmbH, such as a fixed-bed continuous reactor and a new 4-fold -high pressure reactor setup with feeding high pressure gas burettes for high throughput quick testing of catalysts and for kinetic measurements (Figure below).

The primary goal of CO2BioFeed to develop a process chain for the production of at least one large volume value-added chemical intermediate, in which all the carbon stems from renewable sources.

4-fold -high pressure reactor setup with feeding high pressure gas burettes at RUB for high throughput quick testing of catalysts and for kinetic measurements.

Dissemination: The team has carried out in-depth literature studies on the utilization of CO2 and biomass for the production of fine chemicals during this pandemic period and a review article as well as an experimental work have been published.

1. Kushanava Bhauduri, Anindya Ghosh, Aline Auroux, Sauvik Chatterjee, Asim Bhaumik and Biswajit Chowdhury, Soft templating route for the synthesis of mesoporous tantalum phosphates and their catalytic activity in glycerol dehydration and carbonylation reactions, Molecular Catalysis 2022, 518,112074.
2. Sayantan Chongdar, Sudip Bhattacharjee, Shiyana Azad, Rajaram Bal and Asim Bhaumik, Selective N-formylation of amines catalysed by Ag NPs festooned over amine functionalized SBA-15 utilizing CO2 as C1 source, Molecular Catalysis 2021, 516, 111978
3. S. Chongdar, S. Bhattacharjee, Shiyana Azad, Surajit Samui, Saikat Dutta, Rajaram Bal and Asim Bhaumik, Nickel Nanoparticles Immobilized over Mesoporous SBA-15 for Efficient Carbonylative Coupling Reactions Utilizing CO2: A Spotlight, ACS Applied Materials & Interfaces 2021, 13, 40157-40171.
4. T. E. Müller, CO2BioFeed: Kohlenwasserstoffe im Kreislauf halten, Innovationsradar zur Ressourcenwende, Kompetenznetzwerk Umweltwirtschaft.NRW, 2021, 32, online available at https://www.knuw.nrw/fileadmin/public/Redaktion/Dokumente/Publikationen/Innovationsradare/2021/Wachstumskern_CO2_als_Rohstoff_fuer_die_Kunststoffifindustrie.pdf

CO2BioFeed: Kohlenwasserstoffe im Kreislauf halten

Reifegrad der Technologie

Das Forschungsvorhaben wird in einem groß angelegten Konsortium mit Partnern aus Indien und Deutschland (Ruhr-Universität Bochum, Parr Instrument und RWE Power) verfolgt. Im

Hintergrund

Fossile Ressourcen bzw. Kohlenwasserstoffe bilden derzeit den Ausgangsstoff für die Produktion von Kraftstoffen und Zwischenprodukten der chemischen Industrie. Beim Verbrennen von Kohlenwasserstoffen entstehen CO_2-Emissionen. Trotz des Bestrebens der Dekarbonisierung wird es auch zukünftig auf Kohlenwasserstoffe basierende Produkte und Verfahren geben, da nicht überall der darin enthaltene Kohlenstoff substituiert werden kann. Im CO2BioFeed-Projekt wird der Frage nachgegangen, wie die benötigten Kohlenwasserstoffe nachhaltig gewonnen werden können.

Funktionsweise des Verfahrens

Die Lösung stellt ein kreislauforientiertes Verfahren dar. Im Forschungsvorhaben CO2BioFeed wird CO_2 als Ausgangsstoff für weitere Produkte verwendet. Das benötigte CO_2 wird aus der Verbrennung entnommen und dann in wenigen Schritten über entsprechende katalytisch

The project CO2BioFeed was featured in the innovation radar of the state of North Rhine-Westphalia.

ECO-WET

Efficient coupling of water and energy technologies for smart sustainable cities

Project Investigators

Naran Pindoriya
IIT Gandhinagar

Sriniwas Singh
MMM University of Technology Gorakhpur

Arvind Rajput
GIFTCL Gandhinagar

Janki Jethi
GIFTCL Gandhinagar

Markus Duchon
fortiss GmbH Munich

Julia Singer
Sonnen GmbH Wildpoldsried

Smart cities are envisioned to efficiently use two most critical resources: water and energy. Advanced techniques are being developed to conserve water. Similarly, renewable energy resources and smart devices are being implemented to meet the increasing electricity demand of the increasing population.

This project envisions a smart city infrastructure with efficient water and energy distribution networks in a distributed manner. The water-energy Nexus with advanced energy storage and the use of renewable energy resources has not yet been available. The project will implement a software platform with progressive optimization algorithms to interconnect different infrastructures and enable their real-time monitoring and control. Fostering the utilization of renewable energy sources, advanced storage technologies will be deployed and integrated, which allows for modular and distributed operation of infrastructures.

The project meeting for the ECOWET project was held at GIFT City on 26th November 2021. The meeting was attended by the project partners, IIT Gandhinagar, GIFT City, and MMMUT Gorakhpur from the Indian side and virtually by Fortiss GmbH from the German side. The meeting was kicked-off with a short discussion on the project status followed by detailed discussions on use-cases. Apart from meeting, a field visit at all

the project use-cases was also organized. Not required, the project timeline was revisited with contributions and milestones from each partner.

The test run (v2) of the fuzzy logic-based control algorithm is successfully completed for

autonomous operation of aeration process at testbed, Sewage Treatment Plant (STP) of GIFT City. Another battery switching box has been installed and its performance is validated at testbed WTP, GIFT City for use-case 'Energy management of combined loads and batteries of Water (WTP) and Energy (Streetlighting) infrastructures'.

ECO-WET project meeting on 26th November 2021

Mr R Madhan, Director, IGSTC had visited IIT Gandhinagar and GIFT City for a short discussion over the ECO-WET project on 1st December 2021. The meeting was attended by the project partners, IIT Gandhinagar and GIFT City. The meeting discussed on project status, use-cases and future prospects of the project contribution. Thereafter, he visited the project use-cases at the Sewage Treatment Plant (STP), the Water Treatment Plant (WTP), and other GIFT locations such as Utility Tunnel and Automatic Waste Collection System, GIFT city

Mr R Madhan, Director, IGSTC visiting the GIFT City

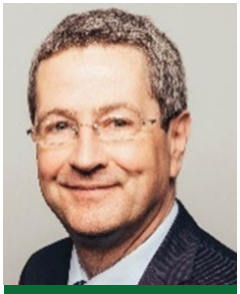
STEEL4LTC

High Strength Spring Steels with Reduced Low Temperature Creep for Light Weight Designs

Project Investigators

Koteswararao V. Rajulapati
University of Hyderabad

G. Balachandran
JSW Steels Salem Works



Robert Brandt
Universität Siegen

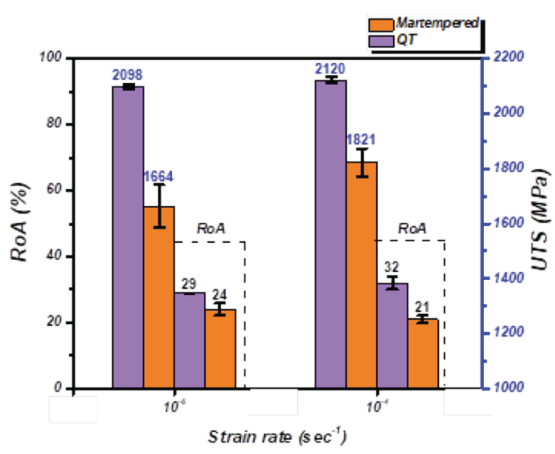
Steffen Klapprott
Muhr und Bender KG

Down-sizing and light weight design of all automotive components especially in chassis area is underway. Higher stress acts on spring material due to its light weight design. The springs being used currently may not withstand very high stresses. Hence, there is a pressing need for the development of advanced spring steels with a combination of higher tensile strength (→2000 MPa), adequate ductility, improved low temperature creep resistance and better high cycle fatigue properties. This could be achieved by suitable alloying strategies, fabrication technologies and heat treatments. This consortium is aimed at developing an advanced spring steel grade with the improved mechanical properties by lab scale, pilot scale and industrial scale melting by continuous optimization of process parameters, fabrication technologies and heat treatments. The underlying micromechanics of plasticity leading to better mechanical properties in comparison to current state of the art materials will be determined by comprehensive microstructural characterization. Detailed experiments will be conducted and a phenomenological description will be developed to understand the improved low temperature creep properties based on the micromechanisms deduced. The role of residual stresses in imparting better low temperature creep properties and high cycle fatigue life will also be investigated. Springs will be manufactured out of the developed steel with optimized chemical composition and field tests will be conducted. This development of a new spring steel grade will be achieved by close interaction between a steel maker (JSW), academic institutes (UoH and USI) and the spring manufacturer (MUB).

JSW is involved in adjusting the alloying content according to requirements for a new steel grade with superior low temperature creep (LTC) resistance. The laboratory melting of 3 new compositions by adding Nb to standard SAE 9254 grade in the amount of 0.03, 0.06 and 0.1 wt.%. was done. Heat treatments and preliminary microstructural investigations on the newly melted compositions are in progress. MUB delivered the inductive treated steel to academic partners to perform necessary mechanical and microstructural investigations at their end.

USI has performed LTC experiments at constant load of 1634 MPa in the temperature (T) range of 298–353 K, and at a constant temperature of 353 K in the stress (σ) range of 1071–1634 MPa. Experimental creep data at all T,σ conditions fit well with respective creep laws of strain hardening theory (SHT) and exhaustion creep model (ECM). However, SHT failed to describe the experimental T,σ of creep parameter a, whereas ECM considerations of a(T,σ) fit well with experimental data with a coefficient of determination value of R2=0.88. Based on these mechanical and subsequent microstructural investigations, LTC rate controlling mechanism hypothesis is formulated as "slip localization by means of dislocation glide in retained austenite phase exclusively." The reason behind decreasing creep rate over time / creep strain is exhaustion of dislocation glide in retained austenite phase due to stress assisted martensitic transformation of retained austenite. Approximately, 1% of RA is transformed during LTC deformation in the temperature range of 298–353 K. Further mechanical and microstructural investigations necessary to substantiate the hypothesis are in progress. A part of research work entitled "A verification of Mechanism Based Theories for Low Temperature Creep of High Strength Steel" was presented by USI in the conference "Ilmenauer Federntag 2021" held at Ilmenau, Germany on 7th October 2021.

UoH has performed extensive martempered heat-treatment at 25^{0}C and delivered 79 samples to USI, Germany, in three different batches. This heat treatment is applied to increase the retained austenite (γR) content which would be suitable to carry out necessary mechanical and microstructural investigations to strengthen the proposed experimental based LTC mechanism hypothesis. Slow Strain Rate (SSR) tests were performed on the martempered and QT samples. Due to the higher content of γR the influence of strain rate is quite evident in martempered samples and can be depicted in the Figure below. The High Cycle Fatigue (HCF) testings for ITW samples supplied by Mubea, Germany, are underway at UoH. The SRF's have participated in two international conferences to present their work to the scientific community. UoH has completed the Round-robin testing to evaluate the γR using characterisation techniques like EBSD and XRD. The new lab-scale melted alloy has been analysed for the γR content and reported. UoH is currently planning to study the effect of strain applied on the material for phase transformation in martempered samples, which can be validated by performing tensile testing at various levels of strains.



Effect of strain rate on QT and Martempered samples tested at 10–6/sec and 10–4/sec strain rates.

Journals / Conferences: M. Muench, R. Brandt, N. Remalli, "A verification of Mechanism Based Theories for Low Temperature Creep of High Strength Steel," Ilmenauer Federntag 2021, Ilmenau, Germany on 7th October 2021.

Cleanwater

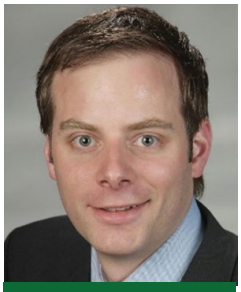
Modular lightweight wastewater treatment units made with TRC for rural and periurban dwellings

Project Investigators

Ravindra Gettu
IIT Madras

Smitha Gopinath
CSIR-SERC
Chennai

Mohit Raina
Raina Industries
Mumbai



Till Quadflieg
RWTH Aachen University
Aachen

Oliver Hentzschel
Betonwerk Hentzschel
GmbH, Elsterwerda

Project Summary

Wastewater treatment (WT) is an essential prerequisite for a healthy society. Still 90% of the worldwide used water enters the environment untreated. Most rural and periurban regions of developing countries have no access to a wastewater treatment plant (WTP), because current mid/big size WTPs require large power supply and space. Currently septic tanks or soak pits are used in many regions that could be replaced with modular and lightweight WT units, which are easy to transport and handle in hard-to-reach locations. The realization of these required systems is possible through the development of high-strength and lightweight materials. By using of durable materials the operating and maintenance costs can be kept as low as possible, which is an important decision criterion concerning the orders. 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. Within the project a design suitable for the innovative material will be developed. Furthermore, the textile reinforcement and concrete matrix will be developed according to the application. These fundamental developments are followed by designing, dimensioning, numerical simulation using finite element analysis and testing structural components and realization of a demonstrator in form of a complete WTP including proof of bearing capacity and function control on site. In addition, from an economic point of view a suitable production and transportation process, as well as a business case for efficient sale and distribution are developed.

First full-scale demonstrator of a textile reinforced concrete wastewater treatment plant

Within the project "CleanWater" (launched March 2020) it is aimed to develop a fully functional wastewater treatment plant (WTP) made from textile reinforced concrete (TRC). Within the last two years the researchers evaluated various textile reinforcements and concrete matrixes in regard to their suitability. This included among others the tensile and flexural strength, and the acid as well as alkali resistance.

Visit of consortium delegations for the presentation of the first demonstrators

In December 2021, Dr. Mohit Raina, and Prof. Thomas Gries, Institute of Textile Technology, visited IIT Madras. Prof. Ravindra Gettu gave them a detailed insight into the production of the demonstrators.

Besides material development aspects the researchers within the consortium developed two designs for the set-up of the WTPs. One set up was based on a rectangular tank design and another one was based on a circular tank design made from individual shaft rings. Both designs have been released in full-scale at IIT-Madras, Chennai, India, within the last months. These tanks will further undergo functionality test for example in regard to leak tightness of the joints and will be further optimised in regard to manufacturing and handling processes in close cooperation with Raina Industries Private Limited.

Consortium partners in front of a "CleanWater" demonstrator (from left: Mrs. Malarvizhi, Dr. Stefie J. Stephen, Dr. Komathi Murugan, Ms. Saisri, Dr. Mohit Raina, Prof. Thomas Gries, Mr. Ramakrishna, Prof. Ravindra Gettu, Mrs. Sophia)

Structural test on prototype TRC WTP at CSIR-SERC (a) Experimental set-up (b) Joint leakage test

Delegations of the consortium partners in front of "CleanWater" prototype TRC WTP segments during the visit to CSIR-SERC, Chennai (from Right: Prof. Thomas Gries, Dr. Mohit Raina, Dr. Smitha Gopinath, Dr. Amar Prakash, Mr. Farvaze Ahmed)

Prof. Thomas Gries and Dr. Mohit Raina also visited CSIR-SERC, Chennai. Dr. Smitha Gopinath briefed about the numerical investigations carried out to finalize the design configuration of TRC WTP; the prototype development of cylindrical & rectangular TRC WTP and about the structural & joint efficiency tests.

Industrial Fellowships

First Call of IGSTC Industrial Fellowships – A Glimpse

The IGSTC-Industrial Fellowship was launched by Prof. Ashutosh Sharma, the then Secretary of the Department of Science & Technology, Government of India on the occasion of IGSTC's 11th Foundation Day on 14th June 2021. The fellowship is tailored for PhD students/researchers in S&T with appreciable track record and aptitude for applied research and technology development. It is designed to encourage young researchers from an early stage of their career to experience an industrial exposure in a German setup.

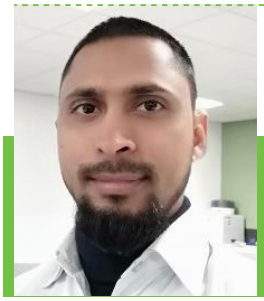
The fellowship is provided at two levels.

1. **PhD Industrial Exposure Fellowship (PIEF):** Young researchers who have completed one year of their PhD course in Science/Engineering from India within an age limit of 30 years were eligible. The duration of the fellowship was up to 6 months.
2. **Post-Doctoral Industrial Fellowship (PDIF):** Fresh PhDs in Science/Engineering with an age limit of 35 years (and within 3 years of completion of PhDs from Indian universities/institutes) were eligible. The duration of the fellowship was up to 12 months.

After an overwhelming inflow of applications and their successful evaluations, the result of IGSTC-Industrial fellowship was announced on 21 December 2021. A total of 20 candidates were selected for this prestigious fellowship.

The following are the brief profiles of 20 successful candidates for PDIF & PIEF awardees.

Post-Doctoral Industrial Fellowship (PDIF) Awardees



Dr. Tauheed Mohammad, IISc Bangalore
Host: AMO GmbH, Aachen

Area of Work: Integrated Perovskite on-Chip Laser. He intends to combine perovskite nanocrystals and quasi 2-D perovskites with silicon nitride to integrate first order distributed feedback grating resonators or ring resonators in order to produce on-chip lasers.

Dr. Bharathi Priya C, CSIR - SERC, Chennai
Host: Fraunhofer LBF, Darmstadt

Area of Work: Adaptive torsional vibration isolators using Magneto-rheological elastomer (MRE). She intends to develop a prototype adaptive torsional vibration isolator (ATVI) using magnetorheological elastomer (MRE), whose dynamic properties can be controlled in real-time using magnetic field.

Dr. Raviraj Verma, IIT Madras
Host: Fraunhofer IAPT, Hamburg

Area of Work: : Design and development of aerospace structural part manufactured through laser+wire based directed energy deposition technique. He intends to use additive manufacturing (AM) techniques to improve buy-to-fly ratio, lead-time, and structural integrity of aerospace components (like satellite bracket, aeroengine stators, etc.)

Dr. Navaneethakrishna Makaram, IIT Madras
Host: Mentalab GmbH, Munich

Area of Work: SmarTaTSS: Tattoo Sensors for Smart Sleep Monitoring. He aims to design and develop a tattoo sensor for the continuous monitoring of the respiratory rate for sleep quality assessment.

Dr. Govind Narayan Sahu , IIT Kanpur
Host: Fraunhofer IWU, Chemnitz

Area of Work: Digital twin for machining with structure integrated active damper. He aims to integrate active damping model of metal cutting vibrations in the digital twin of machining process and improve machining performance.

Dr. Keerthana M, CSIR-SERC, Chennai
Host: Fraunhofer IWES, Oldenburg

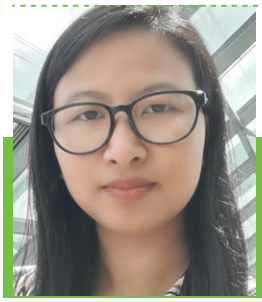
Area of Work: An improved framework for assessment of loads on multi-megawatt wind turbines under yawed flow in Fraunhofer Institute for Wind Energy Systems. She aims to use high fidelity tools such as Computational Fluid Dynamics (CFD) with Actuator Line Model (ALM) to calibrate the correction models adopted in conjunction with BEM.

Dr. Neeraj Paul, IIT Madras
Host: Fraunhofer IWES, Oldenburg

Area of Work: Development of a low-order acoustic propagation model for new-generation wind turbines operating above the atmospheric boundary layer. The model will be able to describe the fluctuating characteristics of noise at different locations in a three dimensional space.

Dr. Balram Singh, University of Delhi
Host: DendroPharm, Berlin

Area of Work: Through his project "NANOpain", he seeks to treat inflammation with novel dendritic nano-drugs without the addictive, potential for a better quality of life for patients with post-operative pain, cancer and chronic pain.



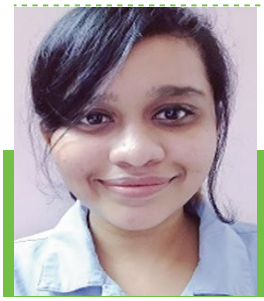
Dr. Sanasam Vipej Devi, NIT Mizoram
Host: KoRoH GmbH, Karlsruhe

Area of Work: Capacity of joints made of high strength steel tubular section. A method for the numerical determination of the design resistance of punching shear will be made available which can be used later for numerical parameter studies.

Dr. Manjunath Mulimani, Manipal Institute of Technology
Host: FAIR GmbH, Darmstadt

Area of Work: Machine Learning. He intends to use novel Machine Learning (ML) and Deep Learning (DL) algorithms to distinguish particles of interest (signal) from other particles (background) produced in large energy particle colliders.

PhD Industrial Exposure Fellowship (PIEF) Awardees



Devika Vikraman, Rajiv Gandhi Centre for Biotechnology Thiruvananthapuram
Host: Nanion Technologies GmbH, Munich

Area of Work: Nanobiotechnology. She intends to study conformational dynamics of CymA by site specific chemical modification in electrophysiology.

Yugandhara Bhosale, IIT Bombay
Host: Airbus, Munich

Area of Work: Large Hybrid Drones. She will work on design and analyse drones with respect to structural and aerodynamic stability to comply with the identified payloads and mission profile.

Sheena, CSIR-NCL, Pune
Host: BASF, Ludwigshafen

Area of Work: Application of Machine Learning along with first principal methods to study industrially relevant reactions. She aims to combine experiments and theoretical computation-based methods with tools like ML that can greatly aid in bringing down the exploration space for computation.

Ashish Sengar, IIT Delhi
Host: Fraunhofer IGB, Stuttgart

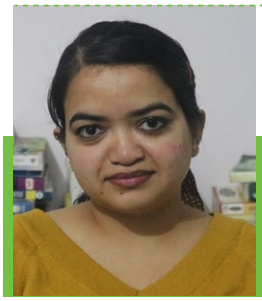
Area of Work: Wastewater treatment: Remediation of micro pollutants present in wastewater. He intends to assess different innovative techniques for the remediation of trace pollutants present in effluent of wastewater treatment plants.

Renuka Sahu, IISc Bengaluru
Host: Airbus, Munich

Area of Work: Nanocomposites. She aims to create a sustainable & mechanically competent alternative using Nanocomposite to presently used fibre sizing, which will help to combat environmental degradation due to aerospace industry, making structures more sustainable.

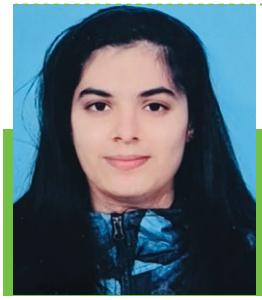
Yamini Mittal, CSIR-IMMT Bhubaneswar
Host: Janisch & Schulz mbH, Münzenberg-Gambach

Area of Work: Field scale planning, building and operation of Constructed Wetlands (CWs) for municipal wastewater treatment. She intends to learn the planning and construction of CWs at field scale from renowned Janisch and Schulz, Germany in order to augment her skills towards development of CWs in India.



Sadbhawna, IIT Jammu
Host: K|Lens GmbH, Saarbrücken

Area of Work: Video Super Resolution (VSR) using Deep Learning. She wishes to develop a VSR algorithm for real-life videos via a deep convolutional neural network that should up-sample each image by a factor of two in each dimension.



Aarushi, CSIR-CSIO, Chandigarh
Host: RWE Power AG, Essen

Area of Work: : CO_2 Bio feed. She intends to work on CO_2 and biomass as feedstock for the production of fuels and chemical intermediates.

Rinku Kumar Prajapat, IIT Roorkee
Host: FAIR GmbH, Darmstadt

Area of Work: Operation of a large-scale facility like the FRS for exotic isotope production in thick target (16g/cm^2). He intends to use fragment separator (FRS) to produce exotic isotopes using Heavy-ion and exotic beam experiments.

Peruswamula Veeravenkata Harish, IIT Bombay
Host: BASF, Ludwigshafen

Area of Work: Synergetic utilization of quantum chemistry and machine learning approaches to accelerate catalyst design. He is interested in understanding and applying catalysis for energy applications from an industrial perspective and machine learning.

Indo-German Bilateral Workshop

Indo-German Virtual Workshop on Artificial Intelligence

In the past years, Artificial Intelligence (AI) has been arousing great interest not only in science and business but in almost all fields of daily life. AI has long since become an everyday technology. Intelligent solutions will be decisive elements of our future.

Due to its overall impact, it is important to discuss and evaluate opportunities and challenges for science, industry and society also in the international context. Hence, during the inter-governmental consultations between Germany and India in November 2019, it was decided to strengthen and enhance the cooperation in the field of Artificial Intelligence.

The first visible effort is the joint AI workshop initiated by the German Federal Ministry of Education and Research (BMBF) together with the Department of Science and Technology (DST) of Ministry of Science and Technology, India and organised by Indo-German Science & Technology Centre (IGSTC). The aim was to bring scientific experts together, enlarge networks and identify fields of mutual interest for future collaboration.

Welcome address by S.K. Varshney, Adviser & Head, International Cooperation Division, DST & Indian Co-Chair, IGSTC Governing body

Indian and German Scientific experts discussed five selected thematic areas of mutual interest related to artificial intelligence (AI) and its implementation at a joint virtual workshop. Areas such as AI for sustainability, Healthcare, Autonomous Robotics, trustworthy AI and Mathematical Foundation were deliberated on September 6 and 7.

The Indian co-chair of IGSTC GB and Head-International division of DST, Mr. S. K. Varshney, and the German co-chair Ms. Kathrin Meyer stressed on strengthening the academia and industry partnership and enhancing cooperation between the two countries that would help the society, particularly in the field of AI, Machine learning and Robotics.

Opening remarks by Kathrin Meyer, Head of Division Cooperation with Asia and Oceania, BMBF & German Co-Chair, IGSTC Governing body

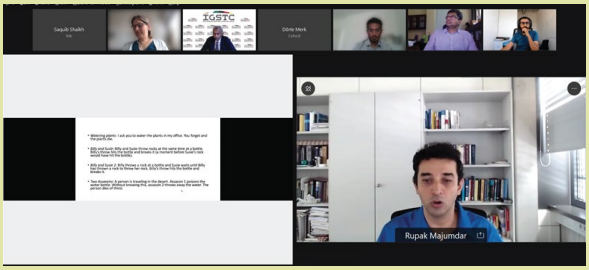
Ms. Schieferdecker from BMBF stated that Germany is focusing on expanding the German economy with AI. India is a strong partner in AI, and the recommendation of the Scientific Advisory Board from this workshop would take these efforts to further heights.

Welcome address by S.K. Varshney, Adviser & Head, International Cooperation Division, DST & Indian Co-Chair, IGSTC Governing body

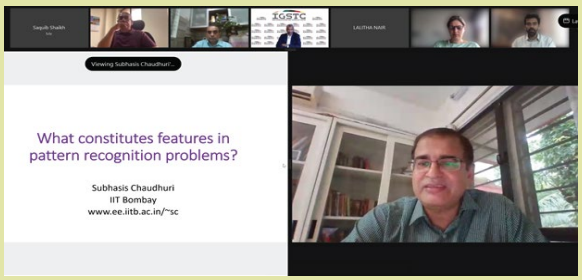
Dr. Murali Mohan, Head-FFT DST, said that globally AI is a very active research topic, and efforts should be made so that India and Germany can cooperate and augment the cooperation. "There are numerous issues to address like upgrading of the technology, skill development and job creation in this field. Academia and industry need to be leveraged in this field, and products need to be geared up," he said.

Address by Dr. K R Murali Mohan, Mission Director, Interdisciplinary Cyber-Physical Systems Head, Frontier & Futuristic Technologies Division, DST

The workshop was accompanied by a plenary lecture by Prof. Rupak Majumdar, Max Planck Institute for Software systems, Kaiserslautern on the Topic: Explainable and Responsible AI. The second day commenced with a plenary lecture by Prof. Subhasis Chaudhuri, Director, IIT Bombay on the topic: What constitutes features in pattern recognition problems.



Plenary lecture by Prof. Rupak Majumdar, Max Planck Institute for Software Systems, Kaiserslautern on the topic: Explainable and Responsible AI

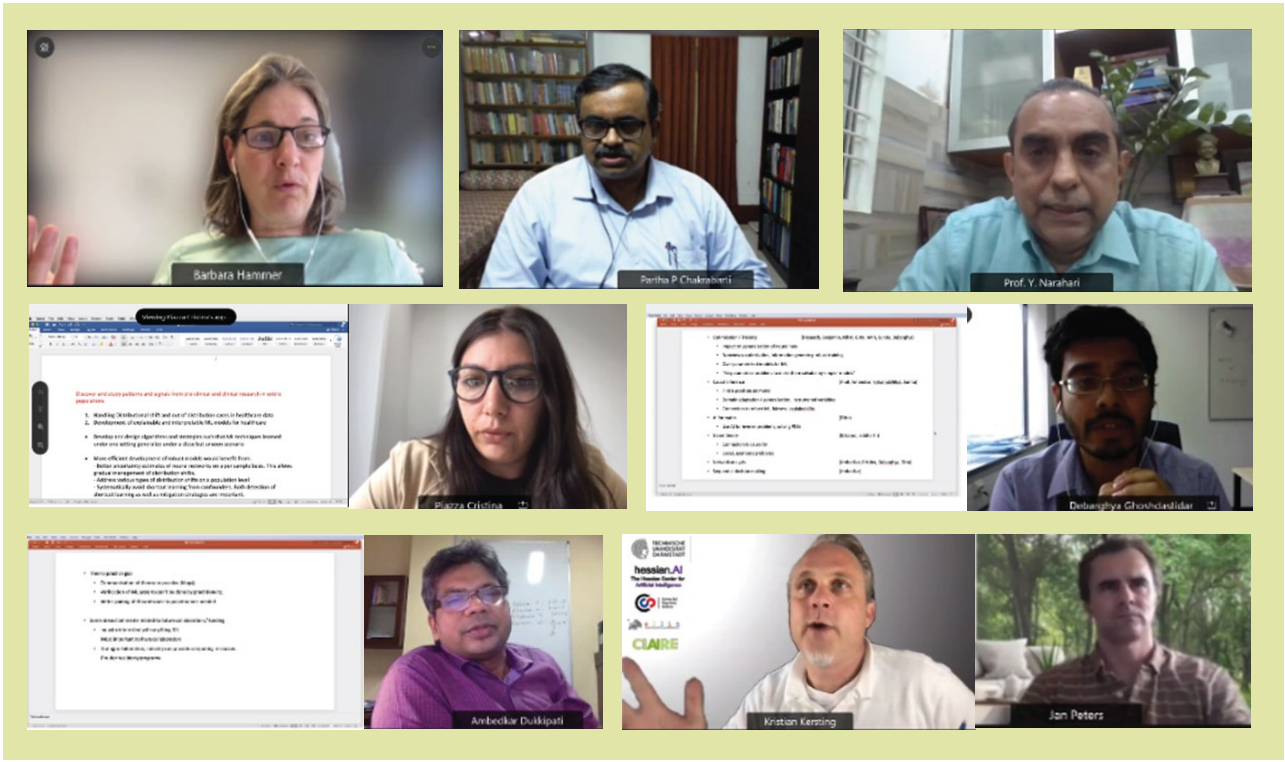


Plenary lecture by Prof. Subhasis Chaudhuri, Director, IIT Bombay on the topic: What constitutes features in pattern recognition problems

Subsequently, five parallel sessions were held over two days on the following topics:

- AI for Sustainability
- Trustworthy AI
- AI for Healthcare
- Mathematical Foundations of AI/ML
- Autonomous Robotics

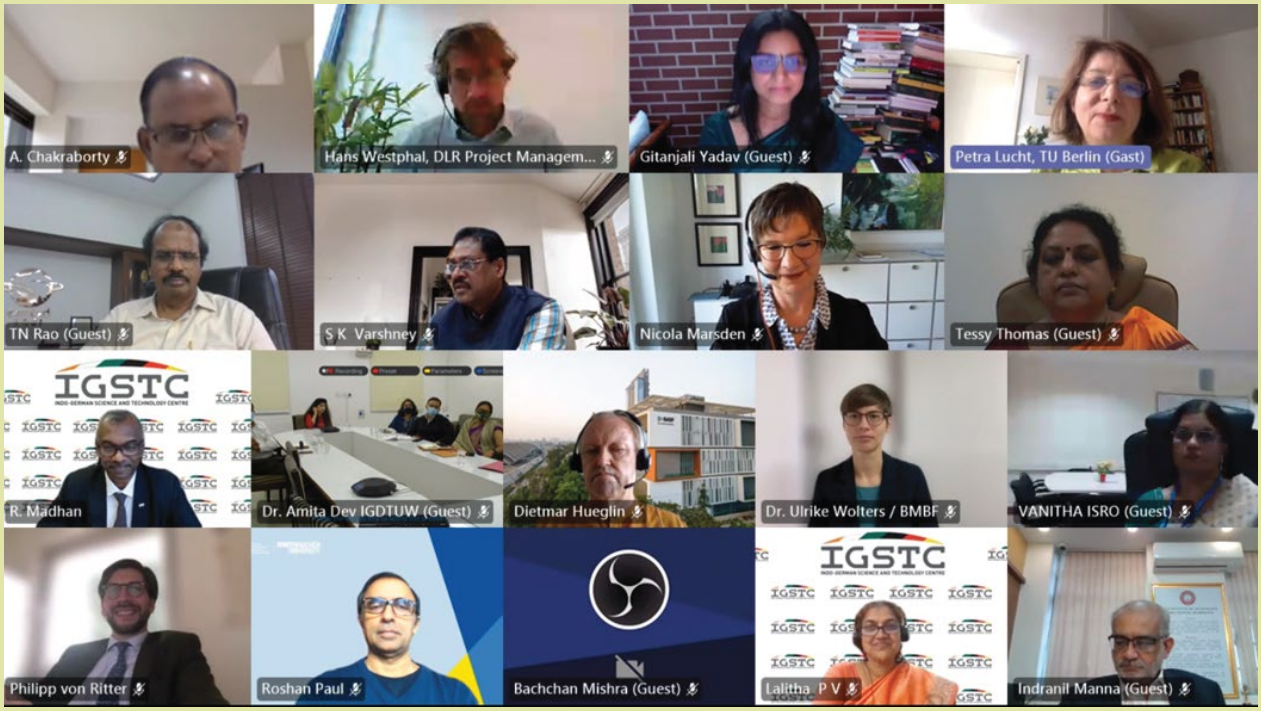
Different Thematic Sessions



Each Session had 12 experts, six each from India and Germany and was also attended by special invitees from the Government, academia, industry, and startups. The concluding session featured presentation of summaries of deliberations in the five sessions followed by a presentation of recommendations and vote of thanks. The session co-chairs submitted a report for various modes of collaboration between India & Germany in the field of AI.

Women Involvement in Science and Engineering Research (WISER)

First of its kind program for lateral entry for women researchers in joint R&D projects between India and Germany launched



A first-of-its-kind programme to promote women in the field of research and development through lateral entry was launched on 24th November 2021 by Indo-German Science & Technology Centre (IGSTC) for encouraging women researchers in joint R&D projects.

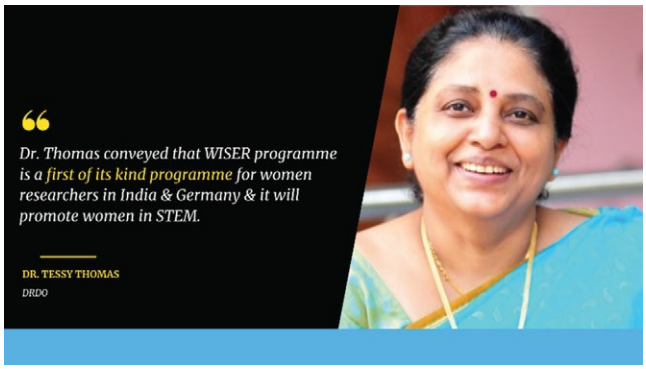
Mr. S K Varshney, Indian Co-Chair and Head, International Cooperation Division, DST, said that WISER will promote gender equality and women's participation in Science and Technology.

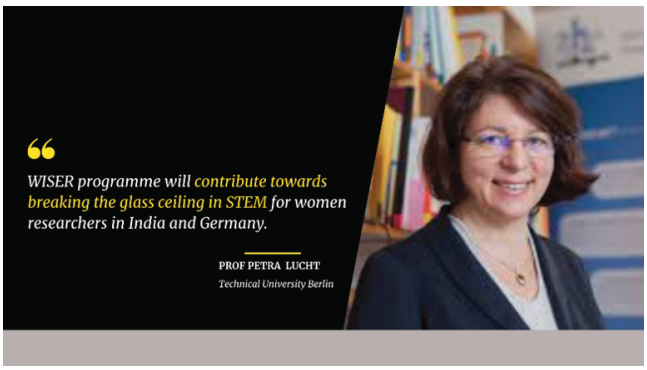
Speaking on behalf of German Co-Chair and German Education & Research Ministry, Dr. Ulrike Wolters, Member Secretary, IGSTC/BMBF, said that this programme will be in addition to the ongoing flagship 2+2 program of the Centre.

This program by IGSTC will support women scientists holding regular/long term research positions in academia or research institutes/industry. The involvement in the program will be possible through lateral entry. There is neither requirement of break-in-career nor any age limit, and it will enable easy participation.

IGSTC is going to support the awardees with a maximum amounting to Rs. 39 L from the Indian side & € 48000 from the German side. WISER program offers 20 awards per year.

The program was launched in the presence of eminent woman scientists from both countries. From Indian side, Dr. Tessy Thomas, DRDO, and Dr. Muthayya Vanitha, ISRO, welcomed and appraised the program. From the German side, Dr. Nicola Marsden, University of Applied Sciences Heilbronn, and Petra Lucht, Technical University Berlin, explained the need of such programs for promoting woman participation in the science and technology.





IGSTC
INDO-GERMAN SCIENCE AND TECHNOLOGY CENTRE

WiSER WOMEN INVOLVEMENT IN SCIENCE AND ENGINEERING RESEARCH

Facilitate lateral entry for women in ongoing S & T projects

Capacity building and networking

Create avenues for long-term Indo-German research collaboration

Open to all areas of STEM

The Indo-German Science & Technology Centre (IGSTC), a joint initiative by the Department of Science and Technology (DST), Government of India and the Federal Ministry of Education and Research (BMBF), Government of Germany invites applications from Women researchers in India/Germany to be a part of an ongoing project in partnering countries in science and engineering.

SALIENT FEATURES

Eligibility
Women holding a regular/long term research position in academia or research institutes/industry

Tenure
3 years

Research stays
1 month/year with fellowship in host country

Age limit
No age limit (preference to Early/Mid-Career researchers)

FINANCIAL ASSISTANCE

Indian Awardee

- Up to ₹ 39 lakh
- Grant includes support for research staff, consumables, contingency, travel and per diem (€ 2300) in Germany

German Awardee

- Up to € 48000
- Grant includes support for consumables, contingency, travel and per diem (€ 2300) in India

APPLICATION ACCEPTED THROUGHOUT THE YEAR

To Apply: www.igstc.org | **Queries:** wiser@igstc.org

Contact: + 91-0124-4929400 @INDOGSTC IGSTC.IndoGerman company/igstc

IGSTC-CONNECT PLUS

IGSTC-CONNECT Plus fellow

Dr Bhogilla Satya Sekhar
Department of Mechanical Engineering, IIT Jammu

Host Institute
Prof. Ines Hauer, Institute of Electrical Energy Systems (IESY)
Otto-von-Guericke-University Magdeburg

Experimental Studies on Unitized Reversible Fuel cell

IGSTC supported short term visit of Prof Satya Sekhar to the host Otto-von Guericke -University Magdeburg under IGSTC-CONNECT Plus programme. The Programme is aimed at boosting Indo-German networking and long term collaboration among the participants of the Indo-German Frontiers of Engineering Symposia (INDOGFOE), which is co-organised by the Department of Science and Technology (DST) and the Alexander von Humboldt Foundation.

Dr Sekhar presented his research work and outcome to the fuel cell group at Otto-von-Guericke-University Magdeburg in the colloquium held on 25-11-2021.

The group worked on the thermodynamic study of integrated proton exchange membrane fuel cell with a vapour adsorption refrigeration system. The abstract of the collaboration work is given below.

With the rising usage of fossil fuels, there is an

Visit to Enercon GmbH (Wind turbine manufacturer)

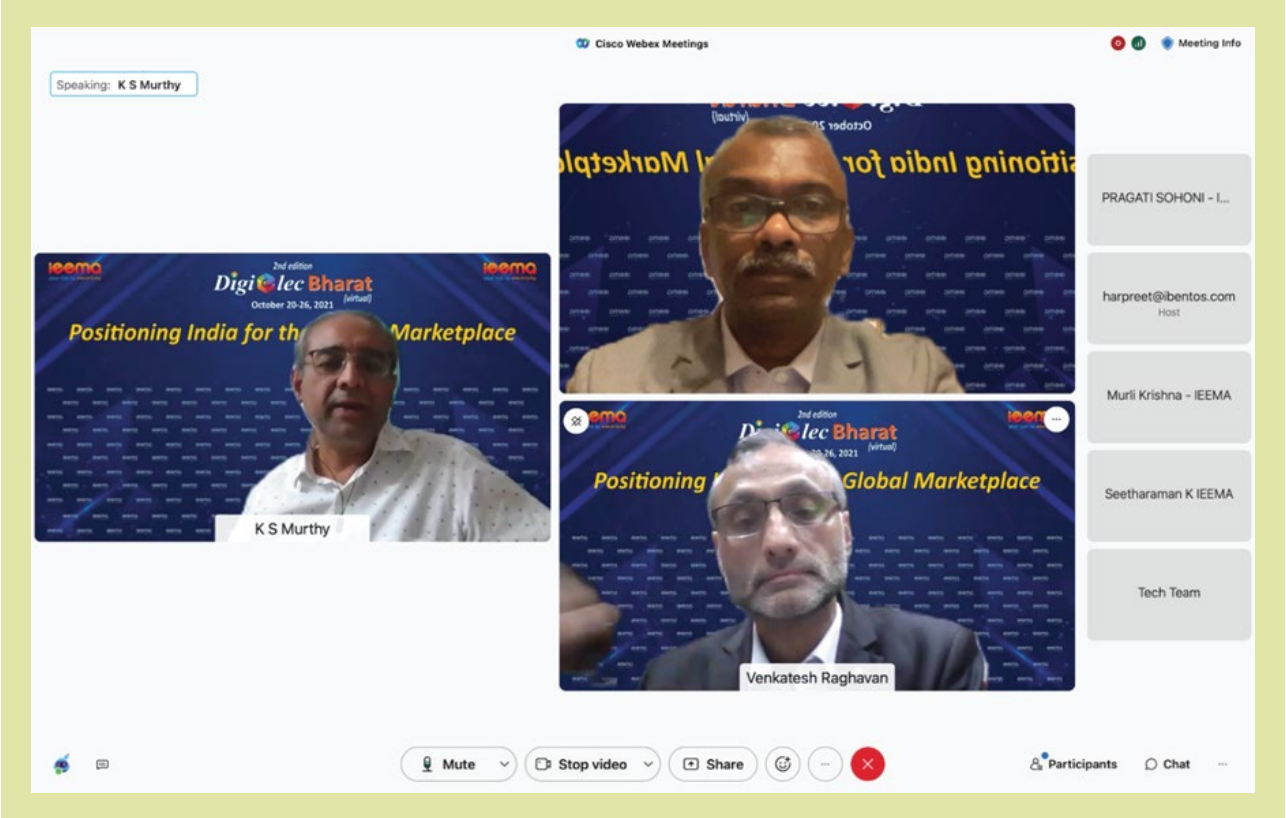
Colloquium Presentation @ Otto von Guericke University Magdeburg

urgent need to develop new technologies specifically based on renewable energy sources to power the vehicles running on fuel. A fuel cell is an electrochemical cell that is used to convert the chemical energy of a fuel directly to electric power. Therefore, fuels cells possess advantages such as smaller size, high efficiency, silent operation, etc. However, there can be significant variations in the size and power output of the fuel cells depending upon the application. The focus of this paper is to estimate the performance of an integrated system comprising of Polymer Exchange Membrane Fuel cell (PEMFC) and vapour adsorption refrigeration system to produce electric output and cooling effect simultaneously. The adsorption system in this study is based on activated carbon and methanol combination. The PEMFC efficiency is generally around 40- 60%, but it can further be improved by incorporating regeneration methods. The effect of operating parameters such as the operating temperature, current density and evaporator temperature on the energy and exergy efficiency of the system is presented. The study shows a remarkable improvement in the performance of the integrated system compared to PEMFC alone. The results show that the system energy and exergy efficiency decrease as the current density value increases. Maximum system energy and exergy efficiency of 63.01% and 29.88% are achieved. The results also reveal that at a current density of 0.8 A/cm^2, the system efficiency increases from 61.35% to 63.01% as the PEMFC temperature increases from 65 to 80°C. In addition, maximum energy efficiency of 65.39% was reported at an evaporator temperature of 5°C and a current density of 0.8 A/cm^2.

Outreach Events

DigiElec Conference Sessions

DigiELEC Bharat was organized by Indian Electrical and Electronics Manufacturers (IEEMA) from October 20-26, 2021. It was a virtual exhibition to provide an opportunity to the Indian Electrical Equipment Industry to showcase its capabilities and readiness. Mr R Madhan, Director, IGSTC participated as a panellist in the session "CEO SESSION ON ACADEMIA INTERCONNECT". He discussed on various industry-academia linkages through the lens of Indo-German cooperation.



VIT – Lecture

Mr R Madhan, Director, IGSTC delivered a lecture at Vellore Institute of Technology on 28th September on "Indo-German R & D Opportunities" which was attended by faculty of several departments of VIT. He briefed the faculty members about the IGSTC funding programmes. He also met the Hon'ble Chancellor of Vellore Institute of Technology Dr G. Viswanathan and discussed about the bilateral funding opportunities.

Indo-German Science & Technology Centre

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