IGSTC

INDO-GERMAN SCIENCE AND TECHNOLOGY CENTRE

NEWSLETTER OF IGSTC

Volume 5 | Issue 2 | May-Aug 2021

INSIDE

Editorial Team

Editor
P V Lalitha

Associate Editor
Saquib Shaikh

ABOUT IGSTC

IGSTC launched a new industrial fellowship programme at its 11th Foundation Day on 14th June 2021. The programme was launched by Prof. Ashutosh Sharma, Fmr. Secretary, DST. The fellowship is for young talented Indian researchers at the PhD and Post-Doctoral level to carry out their research in German industries. IGSTC hopes this programme will encourage young researchers towards applied research. More fellowships are in pipeline and will be launched in near future.

IGSTC also completed its decade since its inception in 2010. IGSTC released a brochure on its decade highlighting the achievements and Indo-German research network built through its programmes.

This issue highlights several 2+2 projects and their various activities. One of the project CO2BioFeed working on the utilization of CO_2 and biomass as feedstock for the production of energy carriers and industrially relevant high-value chemical intermediates had developed new catalyst material which is undergoing testing. In recognition of the innovative approach the project CO_2BioFeed was included in the innovation radar of the state of North Rhine-Westphalia. Project CO_2BioFeed is partnered by Indian Association for the Cultivation of Science, Kolkata; IIT (ISM) Dhanbad; Reliance Industries Ltd., Jamnagar on Indian side and Ruhr-Universität Bochum; RWE Power Aktiengesellschaft, Essen; Parr Instrument GmbH, Frankfurt on German Side. Project ECO-WET partnered by IIT Gandhinagar, MMMUT, GIFT City, fortiss GmbH and Sonnen GmbH organised a workshop on "Power Quality Analysis and Energy Management in Smart Sustainable Cities" on 28th June 2021. The workshop covered knowledge dissemination of power quality use cases and related topics. Three projects on Bioeconomy under areas on vertical farming, sensor technology for soil testing and urban farming, had their first kick-off meetings during this quarter.

A joint Artificial Intelligence workshop initiated by the German Federal Ministry of Education and Research (BMBF) together with the Department of Science and Technology (DST) to be organised by Indo-German Science & Technology Centre (IGSTC) will be held in September 2021.The aim is to bring scientific experts together, enlarge networks and identify fields of mutual interest for future collaboration.

In the near future, IGSTC is about to launch multiple programs on innovative projects, data visualisations and different kinds of fellowships.

IGSTC INDUSTRIAL FELLOWSHIP LAUNCHED TO SUPPORT YOUNG INDIAN RESEARCHERS FOR INDUSTRIAL EXPOSURE AT GERMAN INDUSTRIES AND INDUSTRIAL R&D INSTITUTIONS

The Indo-German Science & Technology Centre (IGSTC) Industrial Fellowship programme was launched by Secretary, Department of Science and Technology, Govt. of India Prof. Ashutosh Sharma on the occasion of IGSTC's 11th Foundation day on 14th June 2021.

"This fellowship would encourage capacity building and would encourage students to think of challenges faced by industry and research solutions for them. It will encourage applied research, technology development and industrial experience in German setup for young researchers," said Prof. Ashutosh Sharma.

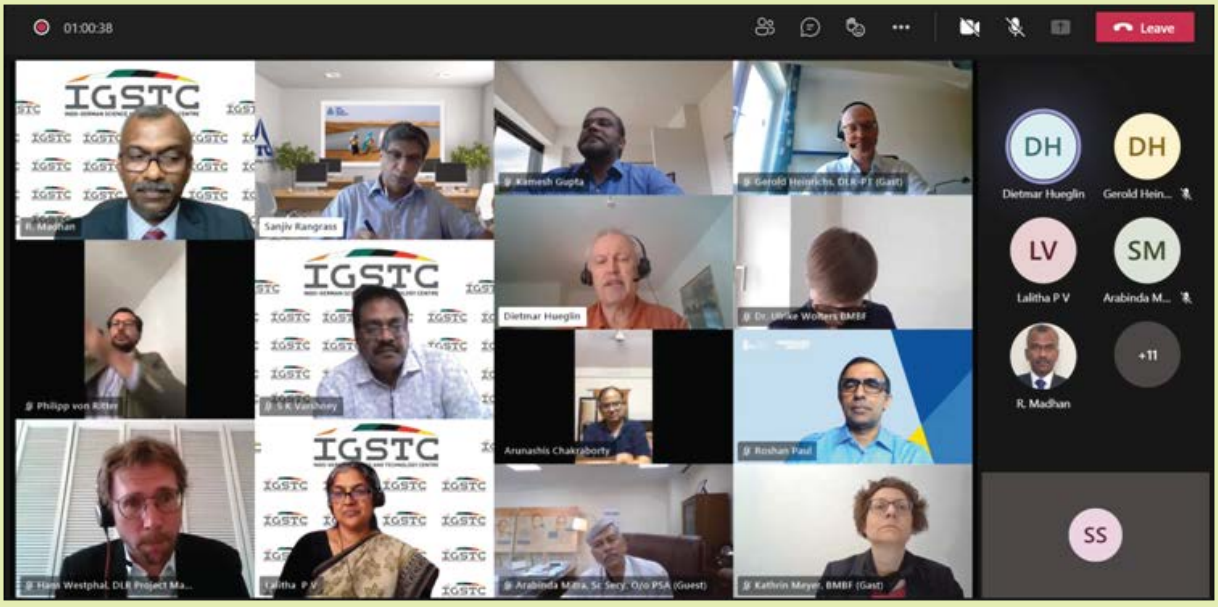
The IGSTC Industrial Fellowship supports young Indian PhD students and Post-Doctoral researchers in Science & Engineering for industrial exposure at German industries and industrial R&D institutions.

Supported by an attractive grant for a maximum of one year, the fellowship aims to motivate young Indian researchers towards applied research and build capacity to foster innovation and technology development through exposure at advanced German industrial ecosystems.

The programme was launched at a virtual meeting in the presence of the IGSTC Governing Body Co-Chairs & members, representatives from Indian & German Governments, Industries and Academia.

Mr SK Varshney, Head, International Division, DST and Indian Co-Chair of IGSTC Governing Body, while congratulating all stakeholders, mentioned that the Centre has created a niche for itself by propagating Indo-German cooperation in applied research and technology development by industries. He requested all scientific agencies and industries to utilize services of the Centre in furthering bilateral scientific cooperation of industrial relevance.

"This programme will bring talented Indian researchers to Germany to work with German companies or government institutes for applied science. As fellows, they can create a long-lasting relationship between both countries for the future" said Ms Kathrin Meyer, Head of Division, Cooperation with Asia and Oceania, BMBF and German Co-Chair of IGSTC Governing Body.



"Since the Centre is promoting research led by industry and supported by academia/ research organisations, it also provides a unique platform which should be utilized for newer cooperation", she added.

The IGSTC industrial fellowship launch was covered by PIB , NDTV, Lokmat, The Tribune and other media outlets.

More information on the categories, eligibility, grant and Fellowship guidelines can be found at www.igstc.org

A DECADE OF IGSTC

IGSTC completed a decade since its inception in 2020. A brochure highligting its achivements over the decade is presented below.

2+2 Projects

HERCET

Development and validation of a cost-effective hybrid electric drive solution for small two wheelers for reducing CO2 emission

Project Investigators

A Ramesh
IIT Madras

S J Dhinagar
TVS Motor Company
Hosur

Jakob Andert
RWTH Aachen University
Aachen

Lars Posdena
VEMAC GmbH & Co
KG Aachen

The Goal of the HERCET (Hybrid Electric drive for Reducing CO_2 Emission in Two-wheelers) research project is to develop and validate a low-cost hybrid electric drive topology for a two-wheeler in order to enable low CO_2 emissions, excellent driving characteristics and a cost-efficient solution simultaneously. The project includes a simulation study to evaluate different hybrid topologies, the development of a hybrid control unit including the control software as well as the integration into a prototype vehicle to validate the concept. The hybrid system should enable a 25% reduction of CO_2 emissions compared to a conventionally driven two-wheeler, while offering equivalent driving performance at reasonable additional costs. The project is partnered by IIT Madras and TVS Motors on Indian side & RWTH Aachen and VEMAC GmbH on German side.

Visit by TVS Motors Engineers on the 24th of July 2021:

A group of engineers from the Indian partner Industry visited the test labs at IIT Madras on the 24th July 2021. They discussed the requirements of the additional mechanical parts needed for the engine test setup that will be provided by them to IIT Madras and also about the instrumentation and data acquisition systems that are used on the test rig. They also visited the other facilities in the Internal Combustion Engines lab and the National Center for Combustion Research and Development where the experiments related to HERCET and other projects are going on. Making use of this opportunity the team in IIT Madras could discuss about the CVT and transient dynamometer setups that are to be created for this project and the support from TVS Motors required.

Visit of TVS Motors team to IIT Madras for Technical Discussions under HERCET

Joint progress meeting of the four partners of HERCET on the 20th of August 2021:

Representatives from RWTH Aachen, TVS Motors India, VEMAC Germany and IIT Madras had a 75 minute discussion on the 20th of August 2021 (Fig.2). Initially the progress made by the partners was presented by members of each group. RWTH presented a representative four-wheeler prototype that theycreated which is ready for evaluation of some of the control strategies be used in HERCET. VEMAC indicated that they are ready with versatile engine calibrating tool and also a controller platform that will have applications in HERCET. TVS Motors indicated their continued support to RWTH and IIT Madras in terms of providing a vehicle, technical data and also by participating in important technical discussions. They also explained the close interaction with IIT Madras and the discussions and support in developing the experimental setup. TVS Motors also explained the hybrid drive simulation models that they have developed and are using for evaluation. IIT Madras explained the engine test bed development, experimental results of performance and emissions, the CVT model that is being developed and is being upgraded, the versions of engine models that have been developed and are under

development. IIT Madras also explained the results obtained on one of the selected hybrid layouts using the models developed. All the members had several technical discussions related to the simulation and experimental results obtained, experiments conducted problems faced and the reasons for certain delays. The future course of action for the near term was also discussed for simulating the hybrid layouts and then finalizing the configuration that can be taken up further for prototyping.

Online meeting of all the teams of HERCET on 20th August 2021

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

T.P.D. Rajan
CSIR-National Institute for Interdisciplinary Science and Technology (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-matrixcomposites (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 der RWTH Aachen University, Germany and the squeeze infiltration processing of aluminium composite will be carried out in the CSIR-NIIST, India. The Indian industrial partner, Fenfe Metallurgicals will develop and supply the suitable Al-alloy for the infiltration and industrial scale processing, 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.

The part of the company CIKONI GmbH is embedded in the research project NearNetMac (Near-net shape Manufacturing of Aluminium Composite) supported by IGSTC to develop and perform process simulations for squeeze-infiltration-textile interaction.

The numerical prediction of the permeability of an orthogonally woven 3D textile is investigated using an ICFD solver. For this purpose, a mesoscopic unit cell is flowed through and the permeability is determined using the relevant flow parameters.

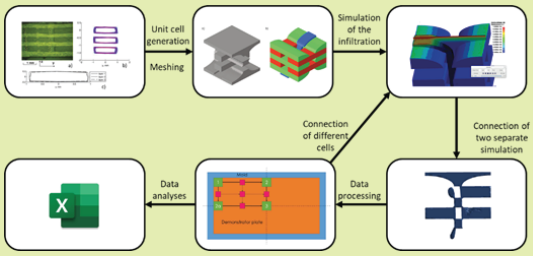


Figure 1: Process flow for the simulative investigation of the non-isothermal infiltration

Due to the multi-scale nature of a reinforced fabric, the influence of fibre bundle flow on permeability in the thickness direction is investigated in a parameter study. The model could be reduced to a quarter of its size by geometric considerations, which means a considerable saving of computation time. In a parameter study, even slight changes in geometry led to a deviation in permeability of up to 65%. Permeability deviation, with the fibre volume fraction decreasing by less than 0.4%.

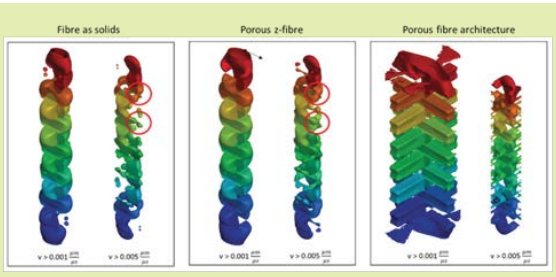


Figure 2: Comparison of velocities using iso surfaces for the flow along the Z-fibre. Here the fluid pressure is marked in colour

The investigations have shown that even small differences in fibre bundle porosity lead to a flow acceleration in a hexagonal unit cell. Nevertheless, the virtual permeability prediction for orthogonal 3D fabrics shows high agreement with experimental measurements. However, for a 3D orthogonal mesh, the intra-laminar flow must be taken into account.

Subsequently, the flow is linked to the temperature to obtain a more realistic representation. Therefore, a simulation methodology is developed to map the infiltration of MMCs as a function of the relevant process parameters. For the investigations, four representative unit cells are used, which are connected by a transfer of the boundary temperatures. In addition, a thermally saturated flow simulation and a coupled unsaturated infiltration simulation are formed per simulation series. The thermal conductivity perpendicular to the fibre axes required for the thermal simulation is determined for this purpose by means of a 2D simulation in the micro plane and compared with analytical formulae of similar geometries. There is good agreement in particular with an analytical formula for square fibre arrangements. The surface coating of the fibres is neglected.

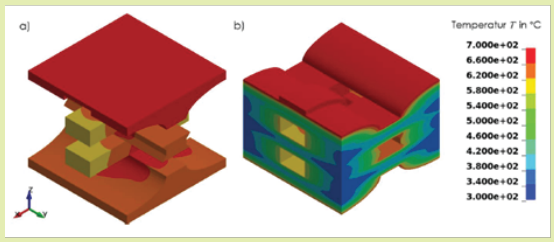
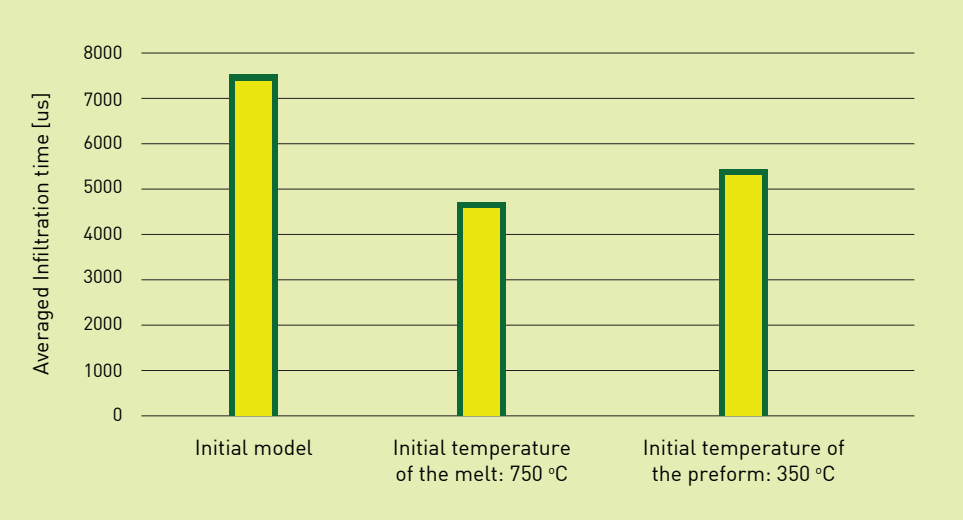


Figure 3: Temperatures a) of the matrix and b) of the fibres of the centre cell

Another objective is to develop and apply a method to numerically predict the time required for the infiltration of a macroscopic demonstration plate with a metal matrix by an alloy, taking into account the mesoscopic unit cell geometry. Using the developed methodology, a simulative parameter study of the infiltration time is performed over the initial temperatures of the melt, mould and preform using the unit cell created. The results map the expected relationship between temperatures and infiltration time. With increasing initial temperatures, the infiltration rate also increases, whereby in the model numerically investigated in this work, the temperature of the melt has a greater influence than that of the preform and the mould.



CO_2 BIOFEED

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

Biswajit Chowdhury
IIT (ISM)
Dhanbad

Praveen K Chinthala
Reliance Industries Ltd.
Jamnagar

Thomas Ernst Müller
Ruhr-Universität
Bochum

Jens Hannes
RWE Power
Aktiengesellschaft
Essen

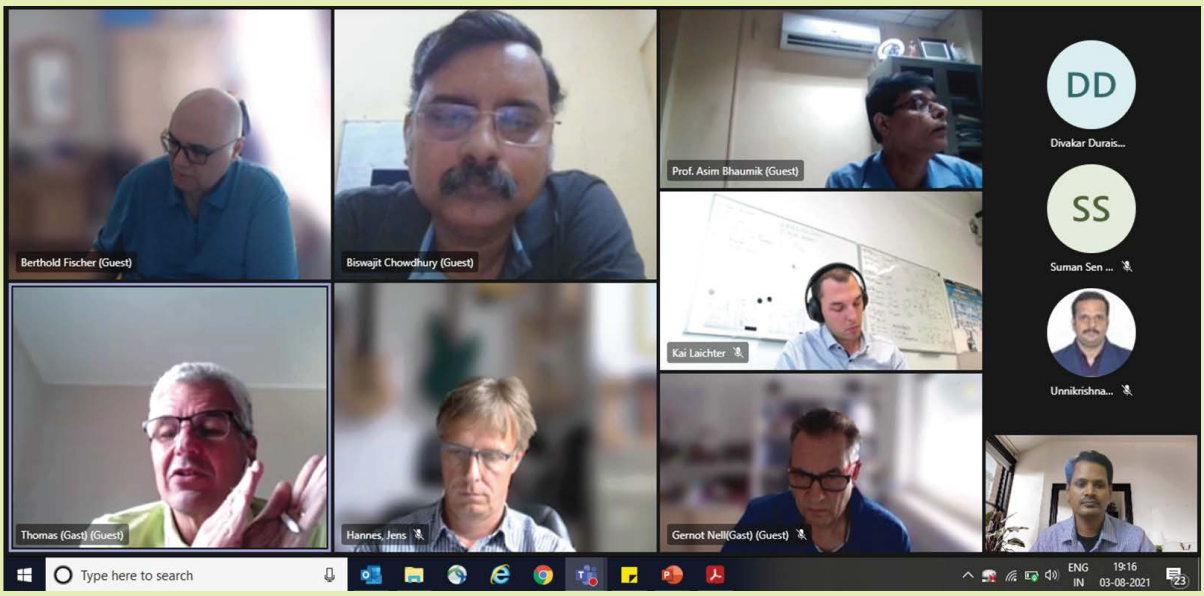
Gernot Nell
Parr Instrument GmbH
Frankfurt

In this 2+2 project, a consortium is working on the utilization of CO_2 and biomass as feedstock for the production of energy carriers and industrially relevant high-value chemical intermediates. Key to the new process is the use of CO_2 as basic building block as well as coupling and soft oxidation agent. Olefins constitute the central platform.

After a kick-off in spring 2020 and several bilateral meetings, a project review meeting was held on 3rd August, 2021 as virtual event. Prof. Thomas Müller, PI, Ruhr-Universität Bochum (RUB) and his team Dr. Berthold Fischer, Dr. Suman Sen, and MSc Kai Laichter along with Dr. Jens Hannes, Dr. Thorsten Liese, Dr. Frank Buschsieweke (RWE) and Mr. Gernot Nell (Parr Instruments, Germany) on the German side interacted with the Indian partners Prof. Asim Bhaumik (Indian Association for the Cultivation of Science, Kolkata -IACS), Prof. Biswajit Chowdhury (IIT-ISM), and Dr. Praveen Kumar Chinthala and Dr. Divakar Duraiswami (both RIL).

The meeting was devoted to the status of the project, work plan, methodology and future course of action. The collaborators' role, responsibilities and mutual support were discussed. Specifically, the successful setup, deployment, and initial testing of the new PARR reactor prototype at RUB were discussed followed by lively discussions on innovative catalyst systems at IIT Dhanbad and the Indian Association for the Cultivation of Science, Kolkata. Possible reaction mechanisms were debated. Understanding of the molecular details may translate into improvements for the targeted reactions. Sending of new catalysts to Germany was agreed upon despite on-going laboratory lockdowns that hamper laboratory work and delivery to Germany alike.

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 CO_2 BioFeed.



Catalyst development: The Indian partners from Reliance Industries, IIT Dhanbad and IACS are currently developing, synthesizing and testing the performance of new highly active catalysts on the base of nanomaterials. The catalysts will be optimised into industrially applicable shapes and evaluated for use in carboxylation and partial oxidation reaction, in particular for epoxidation of olefins. At IACS a high-pressure gas adsorption instrument iSorb-HP1 of Anton Paar Quanta Tech. has been installed and its operation started. CO_2 adsorption studies on the catalysts prepared in India are ongoing making intensive use of the new instrument; the results will be evaluated during the next few months.

Process development: Once obtained at RUB, the new catalyst materials are to be tested thoroughly in advanced reactors that have been assembled to a miniplant comprising the innovative Berty reactor by Parr Instrument GmbH. The new Berty-reactor at RUB with its high tolerance towards temperature and pressure was commissioned with cold and hot test runs. The reactor will be highly useful for studying dissociative CO_2 adsorption and transfer of oxygen to substrates. Online-analytics for analysing complex product mixtures and following the course of the reaction was devised together with a third-party supplier. The gas chromatograph was installed into the miniplant. As a benchmark, methanol production from synthesis gas was successfully accomplished with a commercial catalyst.

Also, in India, instrument procurement activities commenced through online process at IIT (ISM) Dhanbad. Two indium-based catalysts were shown to produce styrene oxide from styrene with 57% conversion and 90% selectivity in the presence of O_2 as oxidant. Ceria (CeO_2) based catalysts showed excellent performance towards extraction of "O" from CO_2. Catalytic conversion of propylene to acrolein was obtained in a fixed bed reactor by using O_2 as an oxidant.

In parallel, RUB is conducting process simulations for the reaction systems to identify and improve the ideal process window. New process conditions will be identified and scaled to mini-plant scale. Successful catalyst candidates will be tested later on pilot plant scale by RWE Power AG (RWE) and Reliance Industries (RIL). In the final step, an ecologic evaluation and a life cycle assessment will be performed for the relevant process steps in the value chain. The primary goal of CO_2 BioFeed is developing 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.

Miniplant at RUB comprising the innovative Berty-reactor (left) and the gas chromatograph for quantifying the components in the complex reaction mixtures (right)

Dissemination: In recognition of the innovative approach the project CO_2 BioFeed was included in the innovation radar of the state of North Rhine-Westphalia. During the period covered by this newsletter, a review article as well as an experimental work have been published. The teamcarried out in-depth literature studies on the utilization of CO_2 and biomass for the production of fine chemicals. The following publications are made during this pandemic period with due acknowledgements to IGSTC for the Grant.

- **A new 2D lanthanum based microporous MOF for efficient synthesis of cyclic carbonates through CO_2 fixation.**

  Sabuj Kanti Das, Anirban Ghosh, Sudip Bhattacharjee, Avik Chowdhury, Partha Mitra and **Asim Bhaumik**

  New Journal of Chemistry, 2021, 45, 9189-9196.

- **Cross-linked Porous Polymers as Heterogeneous Organocatalysts for Task-Specific Applications in Biomass Transformations, CO_2 Fixation and Asymmetric Reactions.**

  Arindam Modak Anindya Ghosh, Akshay R. Mankar, Ashish Pandey, Manickam Selvaraj, Kamal Kishore Pant, **Biswajit Chowdhury** and **Asim Bhaumik**

  ACS Sustainable Chemistry & Engineering (Accepted, 2021)

- **Energy transition and the potential of hydrogen**

  Thomas Ernst Müller

  Jahrestreffen Hochdruckverfahrenstechnik 2021 - HDVT

  Lecture presented on 16.3.2021

- **From Carbon Nanotubes to Fullerenes and Graphene - Preparation, Characterization and Application of an Exciting Class of Materials**

  Thomas Ernst Müller

  IAAM, Session: Smart Biomaterials, Advanced Materials Lecture Series, Session 2, Lecture 1

  Lecture presented on 24.3.2021

- **Energy Storage Systems for the Supply of the Process Industry with Renewable Energy**

  Steffen Schneider, Thomas Ernst Müller

  DGMK/ÖGEW Frühjahrstagung 2021

  Lecture presented on 21.4.2021

- **Power-to-X: New Raw Materials for a Climate-Neutral Chemical Industry**

  Thomas Ernst Müller

  18th European Meeting on Supercritical Fluids - EMSF 2021, Session 13: Green Chemistry 3

  Lecture presented on 5.5.2021

- **Process engineering of catalytic chemical processes Thomas Ernst Müller**

  Research Department Closed Carbon Cycle Economy, Workshop Hydrogen

  Lecture presented on 21.5.2021

- **Power-to-X Technologies, Part of a Sustainable Industrial Ecosystem**

  Thomas Ernst Müller

  18th International Conference on Carbon Dioxide Utilization - ICCDU 2021

  Lecture presented on 19.7.2021

NOMIS

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

Project Investigators

Gorachand Dutta
IIT Kharagpur

Amit Rastogi
Coromandel International Ltd.
Secunderabad

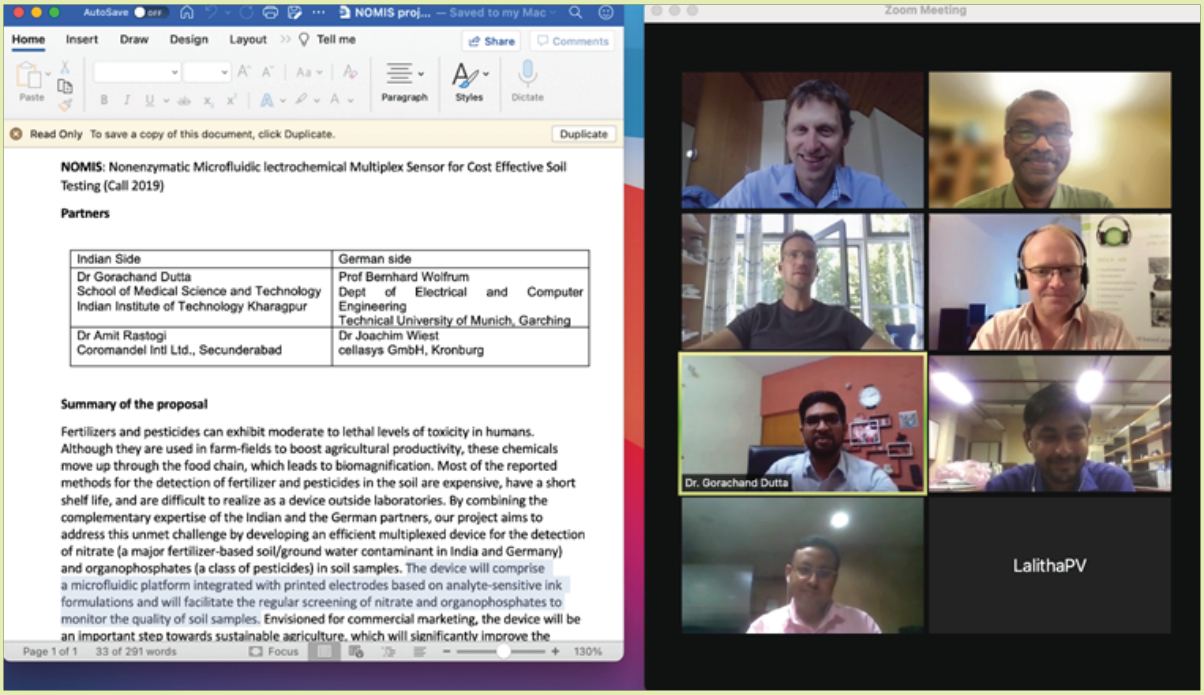
Bernhard Wolfrum
TU Munich

Joachim Wiest
Cellasys GmbH
Kronburg

Project Summary

Fertilizers and pesticides can exhibit moderate to lethal levels of toxicity in humans. Although they are used in farm-fields to boost agricultural productivity, these chemicals move up through the food chain, which leads to biomagnification. Most of the reported methods for the detection of fertilizer and pesticides in the soil are expensive, have a short shelf life, and are difficult to realize as a device outside laboratories. By combining the complementary expertise of the Indian and the German partners, the project aims to address this unmet challenge by developing an efficient multiplexed device for the detection of nitrate (a major fertilizer-based soil/ground water contaminant in India and Germany) and organophosphates (a class of pesticides) in soil samples. The device will comprise a microfluidic platform integrated with printed electrodes based on analyte-sensitive ink formulations and will facilitate the regular screening of nitrate and organophosphates to monitor the quality of soil samples. Envisioned for commercial marketing, the device will be an important step towards sustainable agriculture, which will significantly improve the livelihood of rural farming communities in the countries and help in safeguarding water resources from pollution. Additionally, through the development of a user-friendly soil testing device in this project, awareness on environmental protection will be enhanced.

The project had their first kick-off meeting on 20th August 2021. The project partners discussedthe roadmap and first steps and implementation strategy towards the sensor development. Director, IGSTCalso presented what IGSTC wants from the project outcomes and briefed them about the possibility of Phase 2 funding if the outcomes are outstanding after phase 1.



AutoSave NOMIS proj... — Saved to my Mac

Home Insert Draw Design Layout Tell me Share Comments

Read Only To save a copy of this document, click Duplicate. Duplicate

NOMIS: Nonenzymatic Microfluidic lectrochemical Multiplex Sensor for Cost Effective Soil Testing (Call 2019)

Partners

Indian Side	German side
Dr Gorachand Dutta School of Medical Science and Technology Indian Institute of Technology Kharagpur	Prof Bernhard Wolfrum Dept of Electrical and Computer Engineering Technical University of Munich, Garching
Dr Amit Rastogi Coromandel Intl Ltd., Secunderabad	Dr Joachim Wiest cellasys GmbH, Kronburg

Summary of the proposal

Fertilizers and pesticides can exhibit moderate to lethal levels of toxicity in humans. Although they are used in farm-fields to boost agricultural productivity, these chemicals move up through the food chain, which leads to biomagnification. Most of the reported methods for the detection of fertilizer and pesticides in the soil are expensive, have a short shelf life, and are difficult to realize as a device outside laboratories. By combining the complementary expertise of the Indian and the German partners, our project aims to address this unmet challenge by developing an efficient multiplexed device for the detection of nitrate (a major fertilizer-based soil/ground water contaminant in India and Germany) and organophosphates (a class of pesticides) in soil samples. The device will comprise a microfluidic platform integrated with printed electrodes based on analyte-sensitive ink formulations and will facilitate the regular screening of nitrate and organophosphates to monitor the quality of soil samples. Envisioned for commercial marketing, the device will be an important step towards sustainable agriculture, which will significantly improve the

Page 1 of 1 33 of 291 words Focus 130%

MIDARDI-D2P

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

Project Investigators

K Satyamoorthy
Manipal University
Manipal

Dhananjaya Dendukuri
Achira Labs P. Ltd.
Bangalore

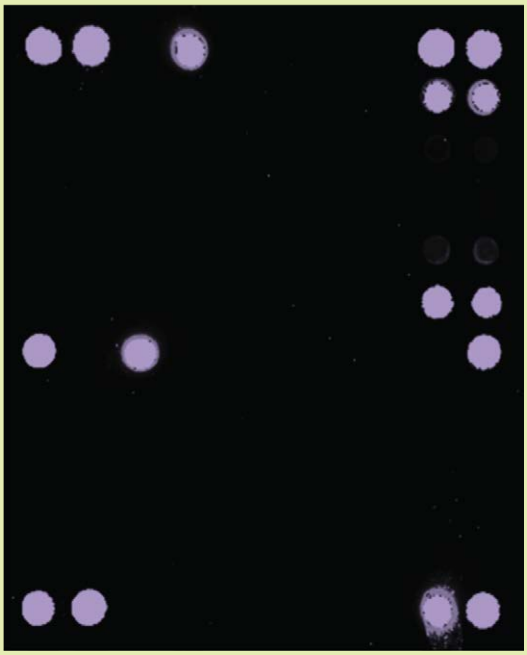
Harald Peter
Fraunhofer
IZI-BB Potsdam-Golm

Joerg Nestler
BiFlow Systems GmbH
Chemnitz

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 spite of the COVID-19 situation, limited progress was made in the MIDARDI-D2P project during the period May to August 2021. The microarray layout was standardized by the German collabarators and different probes were tested for their efficiency. Experiments in the laboratory with microarray as well as on for the micofluidic lab-on-a-chip cartridge were carried out to identify the efficiency of different probes. DNA amplification protocols to be included in the assay were standardized using both bacterial cultures and clinical samples. Based on the discussion between the Indian and German partners, the German collabarators sent the glass microarray panels for testing in Indian laboratories. The amplified DNA was labelled with suitable dyes and hybridized to the microarrays to test for specificity, sensitivity and potential cross-hybridizations. The results at Manipal showed that there was no cross-hybridisation and the signals were found to be positive for all the species-specific probes that have been included in the current layout. Achira Labs has built a portable version of the reader to

interface with and read the microfluidic cartridges fort he project. A sensitive two-colour fluorescence detection system along with cartridge interfaceing has been built. A custom electronics board that can provide controlled heating, LED control and fluorescence imaging using a CMOS camera was built and integrated along with the mechanical elements required. The cartridge produced by BiFlow, the German industrial partner has been successfully integrated with the portable reader built by Achira.



False-color image of microarray (left), hybridized with fluorescent-labelled DNA from specific bacterial cultures Fluorescent array chip reader developed at Achira which can be interfaced with Bioflow system from German Team

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

The interim project closure meeting for the ECO-WET project was held virtually on 29th July 2021.

The meeting was attended by all the project partnersfromIIT Gandhinagar, GIFT City, and MMMUT Gorakhpur from the Indian side, fortiss GmbH and Sonnen GmbH from the German side. The meeting was hosted virtually by fortiss GmbH. It was the interim closure meeting with the status and detailed updates on use cases. Moreover, the project timeline was revisited with contributions and milestones from each partner. The future course of action for Indian partners, along with the final project closure meeting schedule and workshop regarding project knowledge dissemination, has also been planned in the meeting.

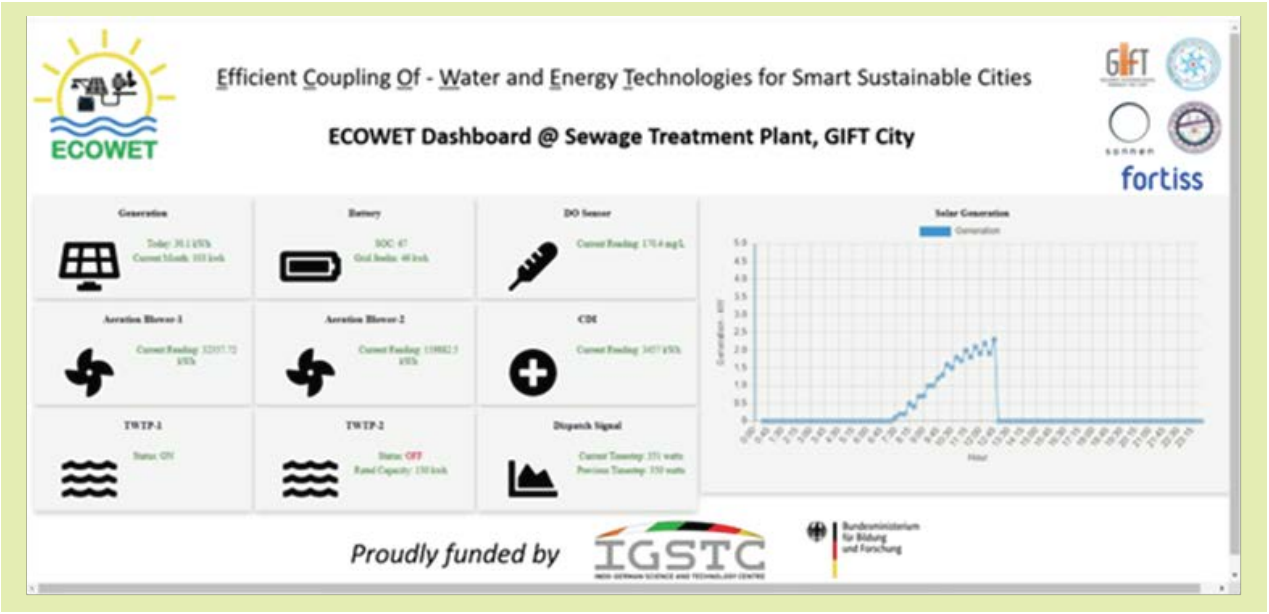
A python based tool entitled "pymonics" has been developed along with its web version for carrying out harmonic analysis.

Link for pymonics web tool - https://ecowet.venkateshpampan.repl.co/

Link for pymonics python tool - https://pypi.org/project/pymonics/

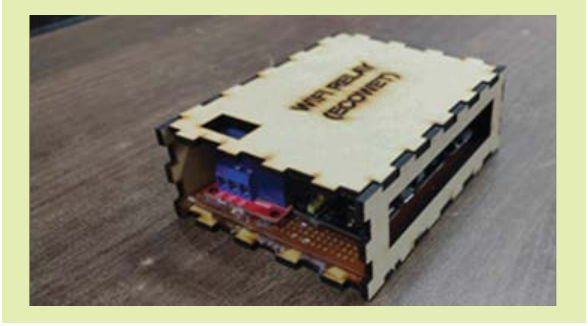
A workshop entitled "Power Quality Analysis and Energy Management in Smart Sustainable Cities" has been organised on 28th June 2021. The workshop covered knowledge dissemination of Power Quality use cases and related topics. Apart from lectures, a hands-on session was also organised, which covered the implementation part of the "pymonics tool". More than 80 participants from different Universities had participated in the workshop.

The initial test run (v1) of the fuzzy logic-based control algorithm is finished for autonomous operation of aeration process at testbed, Sewage Treatment Plant (STP), Gift City. The Wi-Fi contactor relay has been installed for



automatic operation of CDI based on Start/ Stop condition of Treated Sewage Transfer Pump at STP, Gift City to operate the Capacitive Deionization plant. The battery switching box is installed and validated at testbed WTP, Gift City for use case 'Energy management of combined loads and batteries of Water (WTP) and Energy (Streetlighting) infrastructures'. An OEMOF based EV charger is simulated for optimal decision strategy of Sonnenbattery.

1. "SuperCap-Python: An Open-source Python based Super capacitor Modelling Package", Venkatesh Pampana, Daniel Lavin, Markus Duchon and Ankit Srivastava, ICGET 2021
2. "Deployment of MEMO-ESPRIT python tool at GIFT City testbed for Harmonic/Interharmonic analysis", Naran Pindoriya et.al, Electric Power Components and Systems
3. An ECOWET dashboard is completed and successfully installed at Gift City network and given below are a few pictures.



SMART & WISE

Smart and reliable water and wastewater infrastructure systems for our future cities in India and Germany

Project Investigators

B S Murthy
IIT Madras

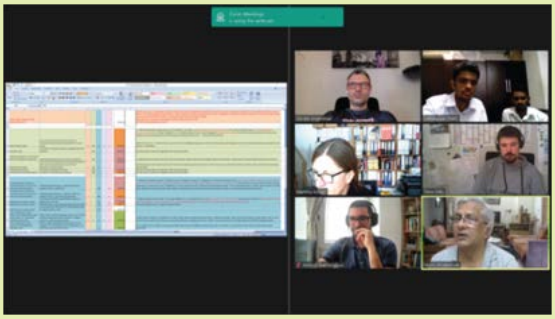
Ashok Natrajan
Tamil Nadu Water Investment Company (TWIC)
Chennai

Theo Schmitt
Heidrun Steinmetz
TU Kaiserslautern

Martina Scheer
Ingenieurbuero Scheer
Oberstdorf

Gerald Angermair
tandler.com GmbH
Buch am Erlbach

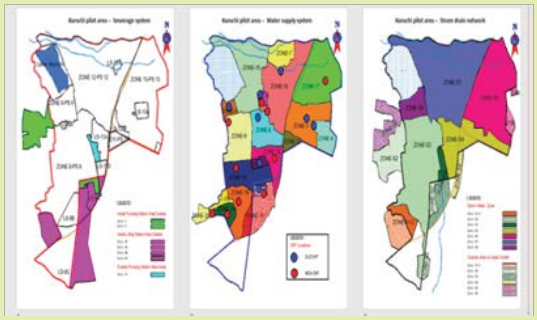
The overall goal of the Indo-German research-project SMART & WISE is to support the implementation of reliable and sustainable water and wastewater infrastructure systems with added value for smart cities. In 2020, the focus was on the development of structured planning methods that could be used in both India and Germany. Planned trips to the partner country during 2020 had to be canceled because of COVID-19 related travel restrictions. However, regular online meetings, once every fortnight, ensured that work on the project continued as smoothly as possible.



On-line meeting amongst the partners

On-line meeting helped to curate the secondary data in order to prepare the models for application to pilot areas. Also, new planning methods for urban water infrastructure could be developed. The approaches followed include (1) the planning and renewal of water supply systems considering alternative water resources, (2) a sustainable stormwater management that combines discharge and the use of different water sources and (3) the resource-oriented treatment and recycling of sewage. First outcomes of the project were presented at the IWA Digital World Water Congress from 24th May to 4th June 2020 (Fig. 3). Starting from smart water concepts, the project team shows an approach for guidance for a sustainable stormwater management.

Screen shot of on-line participation in IWA Digital World Water Congress



Pilot study area in Coimbatore

On the basis of above planning methods, the development of software tools was driven forward. A new module has been developed for optimal routing of pipelines in sewerage and water supply systems within the ++Software platform. Two new tools have been developed for (i) retrofitting of existing sewerage systems with optimal scale of treated grey water and wastewater recycling to reduce stress on fresh water demand and (ii) optimal design of new sewerage systems with on-site grey water treatment. These developments have been summarized in two publications:

- Dev, A., Dilly, T. C., Bakhshipour, A. E., Dittmer, U., &Bhallamudi, S. M. (2021). Optimal Implementation of Wastewater Reuse in Existing Sewerage Systems to Improve Resilience and Sustainability in Water Supply Systems. Water, 13(15), 2004.
- Bharade, A., Dilly, T.C., Bakhshipour, A.E., Philip, L., Dittmer, U. and Bhallmudi, S.M. (2021). Optimal Design of Sewerage Systems with On-site Grey Water Treatment and Recycling. Accepted for poster presentation in the conference AQUA≈360: Water for All – Emerging Issues and Innovations, 31st August to 2nd September 2021, University of Exeter, United Kingdom.

STEEL4LTC

High strength spring steels with reduced low temperature creep for light weight designs

Project Investigators

Koteswararao V. Rajulapati
University of Hyderabad (UoH)

G. Balachandran
JSW Steels Salem Works (JSW), Salem

Robert Brandt
Universität Siegen (USI)

Steffen Klapprott
Muhr und Bender KG (MUB), Weißensee

JSW with support of academic partners is involved in adjusting the alloying content according to requirements for a new steel grade with superior LTC resistance. The laboratory melting of new alloying compositions are in process at JSW. Whereas, MUB has involved in delivering the inductive treated SAE 9254 steel grade to academic partners to perform necessary testing at their end.

USI proposed the hypothesis of in homo geneous plastic deformation leading to a load partitioning between the components of a martensitic structure along with transformation induced plasticity as responsible LTC mechanism in high strength spring steel. To verify this formulated LTC hypothesis, USI has set-up a list of LTC experiments at various stresses and temperatures in the temperature range of RRT–80^0 in close collaboration with TU-Dortmund. These experiments are in process. In addition, stress and temperature step tests will be performed to identify the responsible LTC rate controlling mechanism by determining activation volume & activation energies respectively. The planned axial and diametral strain measurements during LTC will deliver the evidence on the possibility of phase transformation as LTC controlling mechanism.

Despite the hurdles caused by COVID-19 and the associated complete closure of UoH during 2020, UoH was successful in procuring a resonance-based high cycle fatigue (HCF) testing equipment in time with

IGSTC grants. Currently, preliminary testing of the samples are going on. Besides, UoH has performed various heat treatments to increase the retained austenite content to verify the "Load partitioning" hypothesis as LTC mechanism in high strength spring steel. Structure – property correlation studies on the martempered samples are done by means of X-ray diffraction, SEM-EBSD and tensile testing. The design of subsequent slow strain rate testing on martempered samples are in process.

In addition, the consortium is having one-to-one scientific meetings on bi-weekly basis via video conference for an in-depth scientific discussion.

HCF machine installation and training.

CLEAN WATER

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

Project Investigators

Ravindra Gettu
IIT Madras

Smitha Gopinath
CSIR-Structural Engineering Research Centre
Chennai

Mohit Raina
Raina Industries
Mumbai

Till Quadflieg
RWTH Aachen University
Aachen

Oliver Hentzschel
Betonwerk Hentzschel GmbH, Elsterwerda

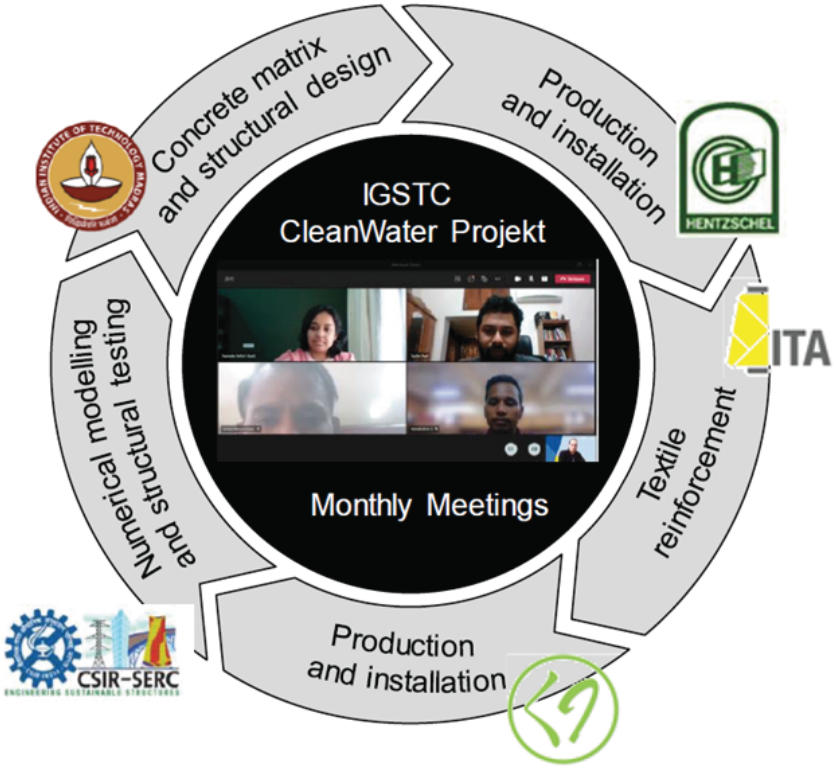
Wastewater Treatment (WT) is an essential prerequisite for a healthy society. 90 % of the world-wide used water enters the environment untreated. Most rural and periurban regions of developing countries have no access to a wastewater treatment plant (WTP), because current mid/big size WTPs require large 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.

German sewage treatment plant manufacturers are expecting more than 20,000 WTPs to be sold in the European market by 2023. In addition, German SMEs are expecting a very high demand for WTPs due to efforts regarding new wastewater quality regulations by governments and organizations in China and India. About 250,000 of prefabricated WTPs are needed in India.

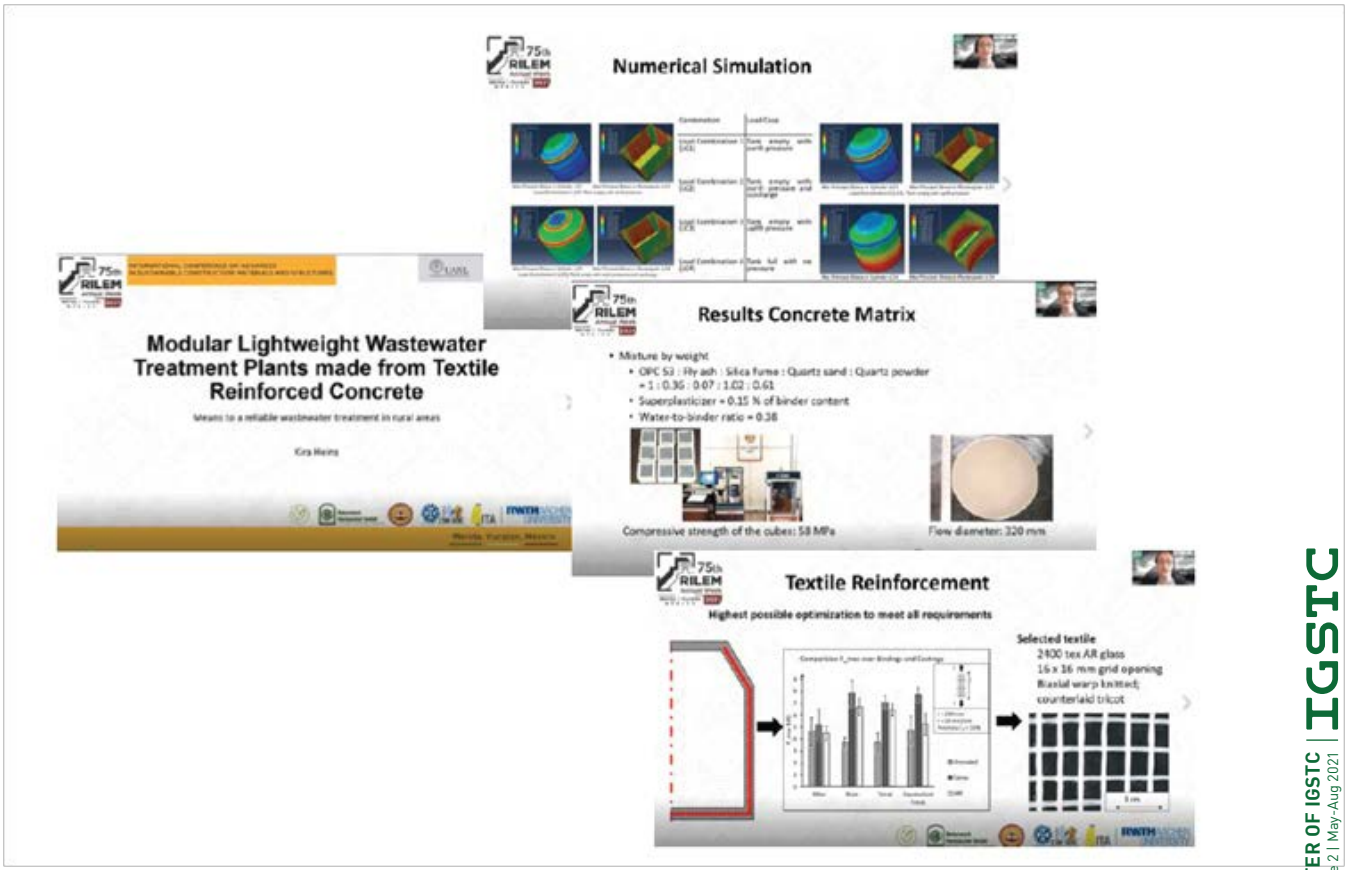
Close cooperation despite large distances

As a part of the Indo-German initiative for promoting bilateral technology development and transfer the CleanWater project has been launched in April 2020. International travelling restrictions due to the pandemic situation are compensated by a close digital exchange of reports, photos and short video clips on testing results and procedures. The main cornerstone of the continuous exchange, however, are the monthly video conferences with the participation of the consortium partners and occasionally other supporters of the project. On the last Friday of each month, the following topics are discussed in the one-hour meeting - performed tests and their results; Completed developments and identified weaknesses that require further information from the partners; Publications and conferences. In addition, the progress of the project is jointly recorded and the next steps are defined.



Clean Water at 75th Rilem Annual Week

After one and a half years of intensive joint research, the Indo-Germanic project consortium took the opportunity to present the project results at the "75th Rilem Annual week" an international conference on advances in sustainable construction materials and structures held from 29 August to 3 September 2021in Mérida, Mexico, in form of a hybrid event. In the presentation titled "Modular Lightweight Wastewater Treatment Plants made of Textile Reinforced Concrete - Means to Reliable Wastewater Treatment in Rural Areas" the first results on the structural design and the development of textile reinforcement and concrete matrix for the application were presented. Furthermore, the results were discussed in detail in the associated paper in the Conference Proceedings. emphasized on the constraints and potential future opportunitiesfor CSIR-CECRI in the field of marine robots & briefed about the IGSTC upcoming project call.



Meetings, Conferences and Events

74th FOUNDATION DAY OF CSIR-CECRI

Mr R Madhan, Director, IGSTC was the Guest of Honor at 74th Foundation Day of CSIR-CECRI. In his virtual address, he emphasized on the constraints and potential future opportunities for CSIR-CECRI in the field of marine robots & briefed about the IGSTC upcoming project call.

MEETING WITH SCIENCE COUNSELLOR, EMBASSY OF INDIA, BERLIN

Mr R Madhan, Director, IGSTC had a virtual meeting with Dr. Madhusudan Reddy Nandineni, Counsellor (Science & Technology), Embassy of India, Berlin on 2nd August 2021. The meeting focussed on discussion and avenues for Indo-German bilateral cooperation through various IGSTC programmes.

3rd VDMA NORTH INDIA MEMBERS MEET

The third meeting of German Engineering Federation (VDMA)Member companies of almost all the engineering sectors from all over North India was held on 27th August 2021 in New Delhi.The meet had topics of discussion that are relevant to the industry, starting from compliance and ease of doing business to automation and digitization. Mr R Madhan, Director, IGSTC was the Chief Guest at the event. He gave the welcome address and briefed the gathering about various IGSTC programmes wherein industry can interface with academia.

Indo-German Science & Technology Centre

IGSTC Secretariat
Plot No. 102, Institutional Area
Sector-44, Gurgaon - 122003, India
Tel: +91-1244929400

German Project Office
German Aerospace Center (DLR-PT)
Heinrich-Konen-Str. 1, 53227 Bonn, Germany
Tel: +49-22838211473

info.igstc@igstc.org
https://twitter.com/INDOGSTC
https://www.linkedin.com/ company/ igstc
https://www.facebook.com/IGSTC.IndoGerman/