



Research in
Germany

Land of Ideas



FOCUS PLASMA TECHNOLOGY



GERMAN-INDIAN
COOPERATION

GER IND



Plasma has many faces

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The Federal Ministry of Education and Research

The Federal Ministry of Education and Research (BMBF) is supporting Indo-German cooperation through its initiative: “India and Germany – Strategic Partners for Innovation.” Starting in September 2008 and scheduled until December 2010, Germany has been presenting itself to India as a Centre of Innovation under the motto “Research in Germany – Land of Ideas”; highlighting Germany’s vast array of universities, research institutes, networks and clusters, as well as companies with a strong research base. One of the prime goals of the Federal Government’s “Internationalisation Initiative” is to expand cooperation in growth markets into countries that actively engage in dynamic research activities.

Scientific and Technological Collaboration (STC)

During a visit by Indian Prime Minister Manmohan Singh to Germany on 23 April 2006, both he and Chancellor Angela Merkel acknowledged the importance of the Scientific and Technological Collaboration (STC) to promote the dialogue between scientists from both countries. To date the collaboration has enabled 1,000 joint Indo-German research projects, involving 4,000 scientists from both countries. Incorporating input from both sides, STC has also completed a total of 100 workshops and produced 1,500 scientific publications.

**Research in
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About Plasma Technology and BalticNet-PlasmaTec

In addition to their fundamental importance as the so called “fourth state of matter,” plasma offers a multitude of technological applications. Plasma technology embraces a large potential of current and promising fields of application so that it has become a key technology. This technology plays an important role for example in the automotive industry; modern engine needs different plasma based hard and low friction coatings, in electronics; each semiconductor is etched by plasma, in medicine; on many implants plasma produced functional coatings can be found, in the development of new materials; many micro- and nano particle are produced or modified with plasma but also such easy consumer goods like plastic bags are often activated by plasma before they get their colour design. Germany is one of the world innovation and market leader of plasma technology leader alongside Japan and the United States. The international network BalticNet-PlasmaTec is one of the most important clusters in Europe in the field of plasma technology. BalticNet-PlasmaTec became during the last years an attractive platform for users and researchers within the field of plasma technology. The network has reliable contacts with scientific and public facilities, as well as with numerous relations to industrial partners particularly in all countries bordering the Baltic Sea, but also in Italy, Netherlands and India. As an international plasma technology network, BalticNet-PlasmaTec aims to support the creation of new jobs in the long term by introducing and disseminating the plasma technology in the universities, industry, SME and public facilities. The main aims include opening up new business fields, fostering company spin-offs, and intense joint marketing and common research and development activities.





From the Baltic Sea to the Indian Ocean

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Aims and results of the project

The aim of the project was to initiate German-Indian cooperation of science and industry for R&D and further education in the field of plasma technology. One main focus is the contact initiation to innovative companies and research institutes in the field of metal working, medical technology, environmental protection and energy sector. The other aims ranges from the project-related cooperation up to acquisition of joint venture partner. But also the cooperation with Indian research facilities is from large interest particularly for the adjustment of the technologies in consideration of the local peculiarities.

The most important results of the project are:

- one research and development contract between a Indian company and a German research institute
- one CLIENT project proposal (German grant); two IGSTC project proposals (joint German and Indian grant)
- joint signature of German and Indian partners: three Letter Of Intent, two Non-Disclosure Agreements and one Memorandum Of Understanding
- establishment of a new company (GmbH) in Greifswald, Germany (founder and owner of the company are Indian partner)
- three new network partners
- successful fair participation and organisation of an own three days workshop in India

The network would like to establish in medium-term and in the long term a long-lasting (sustainable) cooperation in different levels of the Indian scientific landscape. The constancy of the marketing activities should be realised by a systematically integration of Indian partners in bilateral and international activities. Actual the network organises to join with 2 projects at the IGSTC-Call for Proposal for Joint R&D Projects between India and Germany. Interested parties are always welcome. For further information please contact the branch office of the BalticNet-PlasmaTec.





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The network BalticNet-PlasmaTec stands for a technology and market oriented cooperation of science, research and economy in the field of the plasma technology. The network supports existing and initiates new cooperation between universities, industry, small and medium-sized companies and public facilities from the field of the plasma technology. BalticNet-PlasmaTec is working to enhance the perception of the plasma technology in this society. To this end, the network takes over coordination duties for implementation of common, and in particular, cross-border activities. BalticNet-PlasmaTec is a platform for the cooperation between the academic world, public facilities, private companies and individuals.

Technology

- Preparation and coordination of projects & Co operations
- Search and procurement of partners from R&D and from industry
- Acquisition and organization of projects (EU)

Education

- On the job learning
- Postgraduate education
- Placement for PhD students, staff exchange organizations, and apprenticeships

Marketing

- Technology marketing for new procedures & products
- Presentation of R&D - results, services and products
- Preparation of market and feasibility study e.g. for R&D - results
- Event management and company representation at fairs.



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Leibniz Institute for Plasma Science and Technology **FROM THE IDEA TO THE PROTOTYPE**

The Leibniz Institute for Plasma Science and Technology (INP Greifswald) is the largest non-university research institute in the area of low temperature plasmas in Europe, including their basic research and technical applications. On the one hand, INP aims to carry out application-oriented basic research while on the other hand it aims to optimize and further develop established plasma-assisted procedures and plasma products. INP is capable of adapting plasmas to specific customer needs including services and consultations, completed by preliminary and feasibility studies. INP launches research projects starting with the concept right through to building prototypes with market needs. Current top priorities are environmental and energy engineering, surfaces and materials as well as interdisciplinary topics in biology and medicine, specially-designed plasma sources, plasma modelling and diagnostics. INP has not only 3,700 m² of main floor space, but also 26 laboratories, a classified clean room and a microbiological laboratory for interdisciplinary research. The Institute is one out of over 86 non-university institutes of the Leibniz Association. Since 2010 a new building with additional 540m² is available for interdisciplinary research specialised in medical applications of plasma technologies.





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The Leibniz Association is a network of 86 scientifically, legally and economically independent research institutes and scientific service facilities. Leibniz Institutes perform strategic and thematically oriented research and offer scientific service of national significance and strive for scientific solutions for major social challenges.

Leibniz Institutes employ more than 14,200 employees, thereof 6,500 are academics, including 2,500 junior scientists. Leibniz Institutes maintain 2,200 major national and 1,300 international scientific cooperations. About 2,300 foreign scientists come for temporary work at Leibniz Institutes each year. Third party funds of 230 million Euro per year indicate high competitiveness and excellence.

Leibniz Institutes have collected 26 million Euro from the European Union, 45 million Euro from the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG) and 59 million Euro from industry cooperations in 2007. The total budget of all Leibniz Institutes amounts to more than 1,1 billion Euro.

Leibniz Institutes contribute to clusters of excellence on fields as Mathematics, Optic Technologies, Materials Research, Medicine, Climate and Environmental Research, Bio- and Nanotechnology as well as humanities, economics and social sciences. Leibniz Institutes foster close cooperations with universities, industry, and other research institutes, both in Germany and abroad. The Leibniz Association has developed a comprehensive system of quality management. In the unique peer review evaluation process, independent experts assess every institute at regular intervals.





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neoplas control
solutions for your operations in gases and plasmas

Highest Precision - with Measurement and Control Systems for Gases and Plasmas

Environmental and safety requirements are becoming stricter. The demands on quality and efficiency of industrial production are rising not only for economical reasons in many industries. Optical spectrometers help to optimize processes, where high degrees of reliability, security and readiness are required as well as excellent accuracy of measurement. neoplas control is a centre of competence for gas and plasma analysis based on laser spectroscopy in the mid-infrared range.

With the product series Q-MACS (Quantum Cascade Laser Measurement and Control System) it is possible to detect lowest absolute concentrations of molecules in gaseous media up to parts per trillion (ppt) in real-time. The Q-MACS technology was developed for various applications like the high sensitive analysis of plasma processes or trace gases. neoplas control also offers components such as laser supplies and detectors, multi-pass optics and equipment for calibration. The portfolio is completed with software solutions and services.

Product Features

- Measurements with very high precision and time resolution up to nano second range
- Simultaneous monitoring of different molecules through the use of multiple lasers
- Lasers and detectors operate at room temperature without extensive cooling
- Compact, modular, expandable and user-friendly





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MicroSystems

ROTH
& RAU**Advanced Plasma and Ion Beam Technologies**

Roth & Rau MicroSystems GmbH is a worldwide operating company that provides advanced technology solutions for the coating, structuring and processing of surface areas through the application of plasma and ion beam processes. The company's process systems feature a modular composition that ensures an easy adaptation of different methods of surface modification, such as Reactive Ion Etching (RIE), Plasma Enhanced Chemical Vapor Deposition (PECVD), Ion Beam Etching (IBE) and Ion Beam Sputter Deposition (IBSD). The process systems are applied in the semiconductor industry, in the production of high precision optics and sensors as well as for research and development.

In-house developed plasma and ion beam sources in various configurations build the basis of all process systems that are developed by Roth & Rau MicroSystems. These are available in form of a conventional parallel-plate-arrangement, as ICP sources and as microwave excited sources with adjustable geometrical configurations. The company has a vast amount of experience in the production of sources and constantly works on the technological development of these.

The product portfolio of Roth & Rau MicroSystems includes process systems for application on single wafers as well as on flat samples. The modular design enables their optimization for the individual requirements of each process (RIE, PECVD, IBE). Furthermore the range of services of the company reaches from consultancy, design, construction, assembly to software development as well as installation and an after sale service.

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About C-MET

Dedicated to the furtherance of competent research and development in the firmament of Electronic Materials, the Centre for Materials for Electronics Technology (C-MET) functions as a scientific institution under Dept. of Information Technology, Ministry of Communications and Information Technology (MCIT), Govt. of India. Besides augmenting core competence, C-MET envisions attainment of self-sufficiency in the sphere of Electronic Materials, Components and Devices to cater to India's strategic- and industrial- applications, exploiting indigenous resources of raw materials.

C-MET is operating with three laboratories located at Pune, Hyderabad and Thrissur. The laboratory at Pune functions as headquarter and extends central coordination support. Each Laboratory has its own area of specialization with requisite infrastructure and expertise. This approach has proven to be successful in creating core competence at each laboratory.

C-MET's Core Competence

- Integrated Electronic Packaging
- Nanomaterials and Devices
- Ultra High Purity Materials
- Materials for Renewable Energy
- Pizosensors and Actuators





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Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

The Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB in Stuttgart, Germany, develops and optimizes processes and products for the business areas of medicine, pharmacy, chemistry, the environment and energy. Under direction of Professor Thomas Hirth, the Fraunhofer IGB is engaged in a broad spectrum of R&D in its fields of competence – Interfacial Engineering and Materials Science, Molecular Biotechnology, Physical Process Technology, Environmental Biotechnology and Bioprocess Engineering, and Cell and Tissue Engineering.

Our abiding goal is the direct translation of research results into sustainable cost-effective and profitable processes and products. Our strengths are to offer complete solutions from laboratory to pilot plant scale. Customers benefit from the synergies and multidisciplinary potential at our institute, which facilitate novel approaches and innovative solutions in areas such as medical engineering, nanotechnology, industrial biotechnology and environmental technology.

In addition to contract R&D, we offer analytical and testing services of reliable and constant quality fulfilling international standards. Applications of plasma technology belong to the main research interests of the Fraunhofer IGB in the field of materials research. The used plasmas are low temperature, low-to-medium pressure ones, enabling a gentle and controlled surface processing. This way we are able to etch surfaces, to graft new chemical functionalities onto the surface or to polymerize a thin film onto the surface providing functions such as scratch-resistance, dirt-repellency, or corrosion protection. By controlling the gas composition, power and other process parameters, a broad spectrum of chemical, physical and biological surface modifications is attainable.





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Institute of Surface and Thin Film Technology (IfOD)

The Institute of Surface and Thin Film Technology (IfOD) was founded in 2000 within the Hochschule Wismar – University of Applied Sciences, Technology, Business and Design.

The IfOD is a research Institute within the Faculty of Engineering and was conceived as an almost completely third party supported research and educational institute. The intention

is to carry the regional economic development and to reinforce the cooperation of science and industry by realising of applied research projects.

Modern scientific processes and methods were bunched on high scientific level in the areas of thin- and thick film technology, plastics engineering and physical analytics like material testing and electron microscopic analysis.

The educational offer, basically addressed to students of the Mechanical-, Process-, Environmental- and Electrical Engineering consists of practicals, lectures, Bachelor and Master Themes to the point of co operational PhD – programs. Besides this educational offer the IfOD has committed itself to the applied, practice focussed research in the named areas. One core area is development and characterisation of new functional materials and composite materials respectively and the development of its production in laboratory and small batch scale. One essential aspect of the strategic focusing thereby consists in development of new materials for chemical sensor technology, fuel cell technology, medical engineering and polymer technology. Hereby a close cooperation with resident companies is rising, allowing for its demands of consulting in materials science and aiming at common development of innovative products.

The working group of the IfOD, actually consisting of four professors, nine scientific co-workers (material scientists, physicists, chemists and engineers) and five technicians has attended to more than 30 research projects during the past years with a total volume of five millions of euro.



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MILMAN© a start-up company established in 1996 by a group of Technocrats is a major player in state-of-the-art Thin Film Equipment and Plasma Process. The main objective of the company is indigenous development of frontline technologies in the area of Thin Films and manufacturing of finest quality physical vapour deposition equipment based on them.

MILMAN enjoys a large customer base in Scientific Research Laboratories, Universities, Institutes of Technology and Industries.

MILMAN specializes in offering complete solutions to customers in the field of Thin Films, Plasma Processing and associated Technologies. The entire chain of activities from Computer Aided design to final production, quality control and Installation of all the equipment manufactured by this group, is strongly supported by specially developed vendor base and state-of-the-art in-house assembly shop run by experts.

Milman provides value added solutions in:

- Custom built thin film coating equipments
- Advance plasma processing equipment based on magnetron sputtering, arc deposition
- Customized solutions for industrial physical vapour deposition equipments
- Plasma Ion Nitriding technology
- Specialized Sub-system viz. Magnetron Cathode, Pulsed Power Supplies, Corona Poling Equipment etc.





Plazma Technologies Pvt. Ltd.

Since 1994 Plazma has sustained long-term growth in turnover & profit. It is based on continuous development of self financed proprietary technology innovations. Research will continue to remain Plazma's core. It's founders Hughen & Arundhati share this passion with over 1,000 Plazma & 37 RoboPlazma customers, which has resulted in numerous patents & awards (like Indian, South African, Canadian, US and European patents). Plazma plans to initiate a multi-year growth to capture market share in growth segment of RoboPlazma enhanced cutting market to take it from current turnover of \$3.5 Million to \$100 Million in 5 years.

Plazma vision

- Be a leader in research and development of various Plasma applications
- Be a global supplier of artificial intelligence driven, vision enhanced RoboPlazma™ systems that reduce manufacturing cycle times drastically.
- Set up Plazma cutting application training centers to benefit customers and students alike.
- Expand the scope of Plazma products & RoboPlazma™ Systems beyond cutting and welding in to other applications.
- Set up strategic alliances with companies with complementary product range to be a global technology leader

Plazma intellectual property

- Protection of Plazma designs, drawings with trademarks, patents & copyrights worldwide to safe guard its intellectual property.
- RoboSwift is a licensed web based encrypted software with embedded server management to control piracy, virus, theft and such related issues.
- Plazma implements Non disclosure agreements with all its employees, suppliers, consultants and vendors.

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One working group at the Institute of Physics from the Ernst Moritz Arndt University is mostly occupied with atmospheric pressure dielectric barrier discharge plasma and its application on biology as well as thin film deposition. The working group deposit hard coating by magnetron sputtering, RF sputtering and soft polymer (hydrogenated) thin film or amorphous coating by dielectric barrier discharge (DBD) plasma. In case of biological studies they have used CH_4/N_2 gas mixture DBD plasma to deposit amorphous hydrogenated carbon nitride $a\text{H-CN}_x$ film. *In vitro* studies with three different cancer cell lines were carried out on the coated surfaces. Preliminary biocompatibility and effect of CH_4/N_2 films have been investigated by measuring cell proliferation. Three different cancer cell MCF-7, Colo-357, and LNCaP suspensions have been exposed on the surface of $a\text{H-CN}_x$ film to investigate the effect of deposited films on viability of cells. Direct plasma treatment also has been done in case sterilization or to kill the different bacteria. As for example atmospheric pressure dielectric barrier discharge (DBD) plasma has been employed on gram-negative bacteria, *Escherichia coli* BL21. Treatment was carried out using plasma generated with different compositions of gases: CH_4/N_2 , O_2 , N_2 , and Ar, and by varying plasma power and treatment time.

The group have studied the influence of nitrogen on the chemical properties of the hydrogenated carbon nitride ($a\text{-CN}_x\text{H}$) film deposited by CH_4/N_2 DBD plasma. X-ray photoelectron spectroscopy (XPS) indicates that carbon and nitrogen form an unpolarised covalent bond in these C 1s, N 1s materials, and the observed chemical shift in the C 1s and N 1s binding energy is explained with respect to N 1s incorporation.

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Break new ground

Plasma could be your solution. So please join us in our pursuit of new horizons.