

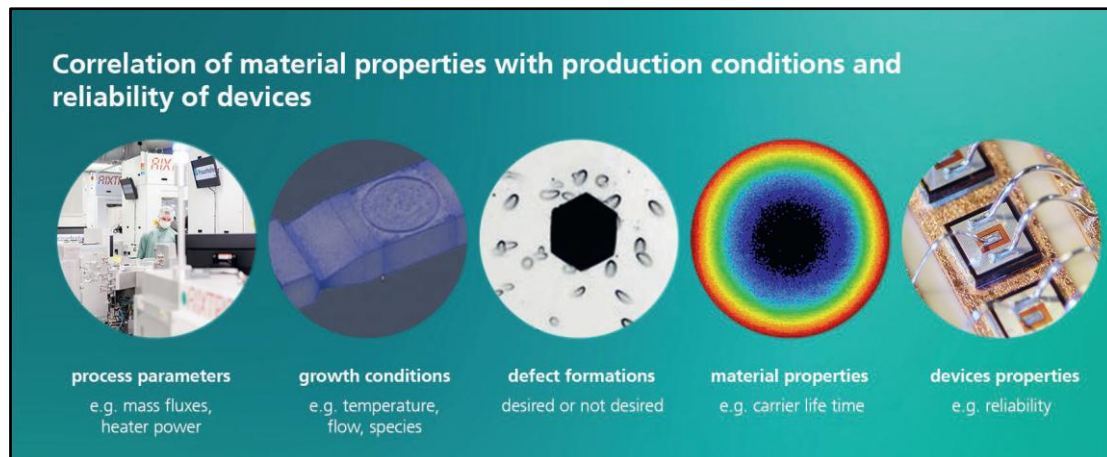
We are pleased to introduce you to Fraunhofer TechFlash - Fraunhofer's Flash News on latest and exciting technologies. This week's TechFlash is about **Fraunhofer's technology and expertise in semiconductor material development.**

Fraunhofer Institute for Integrated Systems and Device Technology (IISB) is Europe's leading research institutions in wide-bandgap semiconductors and power electronic systems. The institute covers the complete value chain for next-generation power electronics, from materials to chip development and from modules and system-level solutions. Its research portfolio spans semiconductor materials and processing technologies, advanced packaging and module design, and complex electronic and energy systems, including ultra-compact converters, modular multilevel converters, electric drive trains, battery storage systems and decentralized energy grids. Fraunhofer IISB operates the entire technological process chain in the field of silicon carbide (SiC).

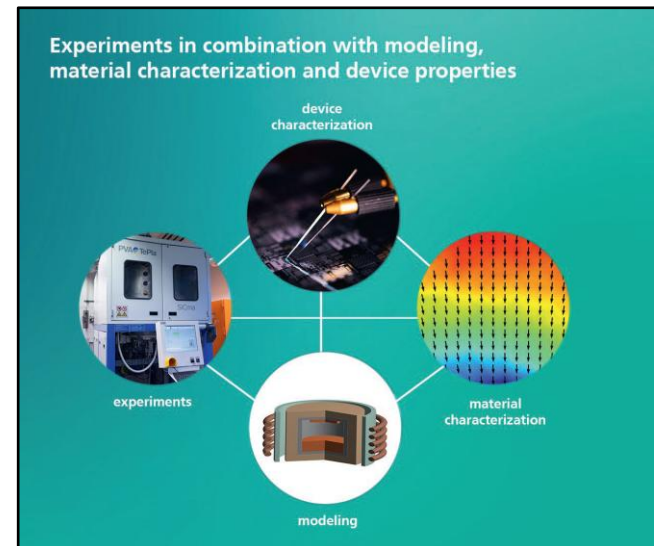
Competences:

Fraunhofer IISB has profound experience in the areas of semiconductor crystal growth, epitaxy, and device processing, including characterization and modelling. In the past, we have significantly contributed to the development of the VGF (Vertical Gradient Freeze) technique for the industrial production of a variety of crystal materials as well as to the epitaxial growth of high-quality SiC (Silicon Carbide) layers. Several national and international research awards underline the achievements of Fraunhofer IISB over the last years for its outstanding scientific technological results.

Strategy



Approach



Services:

- Fraunhofer IISB supports material, device and equipment manufacturers, as well as their suppliers, with advanced scientific and technological solutions.
- Deep expertise in production and characterization of crystals, epitaxial layers and semiconductor devices.
- Support to enhance material quality while significantly reducing production costs.
- Identification of performance and reliability, limiting defects and developing solutions to eliminate or mitigate them.
- Development of technologies for novel materials and tailor material properties to meet the requirements of emerging applications.
- Core focus areas include semiconductors for power electronics, communication electronics, sensors, detectors and quantum technologies.

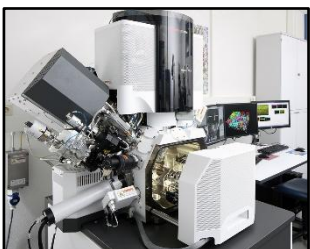
Focus Areas:



Silicon: Fraunhofer IISB performs specific research on the growth of silicon crystals by the Czochralski technique with respect to higher yield and improved material quality.



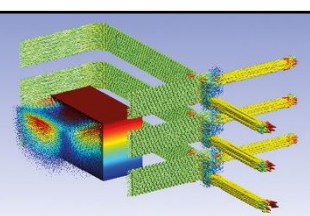
Silicon Carbide: Fraunhofer IISB develops the 150mm SiC epitaxy process with emphasis on improved material quality, thick epilayers, p-doping and minority carrier lifetime



Quantum Materials: Fraunhofer IISB pioneers the development of SiC and diamond for quantum applications. The research covers the entire value chain, from material development, the creation of colour centres, design and processing of quantum devices, and their integration into system demonstrators.



Functional Coatings: Fraunhofer IISB uses spray coating of e.g. SiO₂, Si₃N₄, SiC and TaC to functionalize crucibles and other furnace parts in order to reduce harmful defects and impurities and to increase the lifetime of the furnace parts.



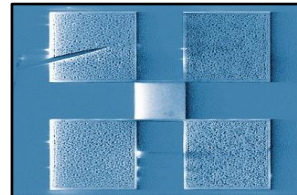
Equipment Simulation: Fraunhofer IISB supports the development of high-temperature equipment and processes by its expertise in numerical modelling of heat and mass transport phenomena. Specific expertise is available for crystal growth and epitaxial processes. We are also experienced with other thermal processes like e.g. wafer annealing.



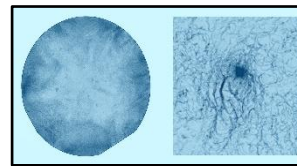
Gallium Nitride & Aluminium Nitride: Fraunhofer IISB develops the HVPE growth of GaN bulk crystals up to 4" diameter. The process is optimized towards a high uniform V/III ratio along the growing interface by comparing in-situ process data, ex-situ determined properties of the crystal with results from numerical modeling of the growth process.



Other Crystal Materials: Fraunhofer IISB has expertise in the growth and characterization of a variety of other semiconductor materials (Ge, GaAs, InP, CdTe) as well as of optical, laser and scintillator crystals (sapphire, LSO, YVO₄, Y₂O₃, CaF₂, CeBr₃) by different melt and solution growth techniques such as Bridgman, VGF or THM.



Material Analysis: Fraunhofer IISB has immense experience in characterization of the optical, electrical, structural, physical and chemical properties of different crystal, wafer and epi materials as well as of partially and fully processed devices.



X-ray Topography: With XRTmicron, Fraunhofer IISB investigates crystallographic defects on a wafer scale, non-destructively, with high measurement speed and the highest spatial resolution.



Joint Labs: Joint Labs offer industry the opportunity to collaborate with Fraunhofer IISB in form of a cross-organizational development team, which works together on the industry's key topics. This promotes a deeper understanding of the technology, which in turn facilitates technology transfer and accelerates integration into the product.

Reference Project: European SiC Value Chain for a Greener Economy

With the European TRANSFORM project, Fraunhofer IISB is building a complete and highly competitive European supply chain for power electronics based on silicon carbide (SiC) power semiconductors. The focus on the development of a semiconductor technology for future SiC substrates with 200 mm diameter, which will significantly reduce the cost of SiC power devices, as currently substrates with a diameter of 150 mm are state of the art. In the Joint Lab in close partnership with the equipment manufacturers, Fraunhofer IISB is developing:

- processes for an advanced multi-wafer SiC epitaxy reactor from the company Aixtron,
- novel equipment for implant activation and substrate oxidation from the company Centrotherm,
- as well as innovative material characterisation by means of X-ray topography with the company Rigaku.



200 mm and 150 mm SiC

Click >> [HERE](#) << to connect with us if you are interested in any of the topics

About Fraunhofer-Gesellschaft:

Founded in 1949, the Fraunhofer-Gesellschaft based in Germany is the world's leading applied research organization. It offers contract-based R&D services for specific industry demand, application-oriented technology development from proof-of-principle up to market-readiness across the value chain and offers technical consultancy and feasibility studies to nearly all the industry sectors. The Fraunhofer-Gesellschaft currently operates 75 institutes and research units throughout Germany. Over 32000 employees, predominantly scientists and engineers, work with an annual research budget of €3.6 billion. Fraunhofer generates €3.1 billion of this from contract research. Our global footprint is very strong, with offices and research centres in the USA, Europe and Asia. Some of our renowned innovations are the MP3 software, white LED's and the smallest of cameras. Fraunhofer has been a long-time trusted innovation partner in India, collaborating with some of the major players in the fields of Material Science, Energy, Environment, Automotive, Electro-mobility, Production Technology, Microelectronics and Smart Cities, working with Industry, Government and Public Sector.

Kindly contact Mr. Aditya Fuke, Senior Manager – Strategic Projects, Smart Cities & IoT at Fraunhofer Office India for further details.

Ms. Anandi Iyer

Director,
Fraunhofer Office India
Website: www.fraunhofer.in | www.fraunhofer.de | www.iisb.fraunhofer.de

Mr. Aditya Fuke

Senior Manager – Strategic Projects, Smart Cities & IoT,
Fraunhofer Office India
e-mail id: aditya.fuke@fraunhofer.in