Extract from the Annual Report 2023
To the website: www.ist.fraunhofer.de/en.html

In focus

Into the future with sustainable energy

“The success of a company is massively influenced by its sustainability performance.”

Prof. Dr.-Ing. Christoph Herrmann, Director of the Fraunhofer IST

Fraunhofer Institute for Surface Engineering and Thin Films IST | Riedenamp 2 | 38108 Braunschweig | Germany

For years, energy prices have been rising – an effect that has been exacerbated by the war of aggression in Ukraine. While energy demand and prices are increasing, fossil resources are dwindling and climate-related disasters are becoming part of our lives.

Reports of forest fires, floods and heatwaves are a constant reminder: Climate protection concerns us all. In order to protect the global climate, the EU has committed itself to limiting emissions and, consequently, to converting to green energy sources. In this time of multifactorial crises, it is important for the Fraunhofer IST to develop robust and sustainable solutions.

In order to achieve the goals of the Paris Climate Agreement and climate neutrality by 2050, the European Climate Law obliges EU member states to significantly reduce greenhouse gas emissions. In 2019, the industrial sector was responsible for 24 % of greenhouse gas emissions worldwide, whilst the transport sector was responsible for 15 %[1]. The automotive sector is one of Germany’s most important industries and a pioneer for sustainable development. The OEM’s decarbonization targets thereby encompass the entire life cycle – “from the cradle to the grave”. To achieve these goals, the product portfolio is being electrified and the supply chain decarbonized.

The Fraunhofer IST develops customized tools that make CO_2 measurable along the entire value chain and identify the technologies with the most favorable CO_2-reduction costs. Our work focuses on methods for measuring sustainability in the life cycle as well as on batteries, hydrogen, photovoltaics and technologies for the achievement of a circular economy.

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[1]Lee, H., Romero, J., (2023): Climate Change 2023: Synthesis Report. Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland.

Sustainability

Sustainability is a tough competitive factor in industry, as sustainability rankings influence the share price and market capitalization of companies. Legal requirements such as the EU's Corporate Sustainability Reporting Directive (CSRD) demand a science-based derivation of sustainability targets. The Sustainability Management department at the Fraunhofer IST provides companies with advice and support in strategy development, target derivation and the development of measures.

What can be measured can also be managed: Tools for the quantification of sustainability

Based on the requirements of customers, competition, legislation, the financial market and technological trends, we identify the relevant target areas. The focus is formed by decarbonization, water efficiency and the circular economy.

We provide our customers with materiality analyses, tools for measuring the sustainability performance throughout the life cycle, certified carbon footprints and decarbonization roadmaps. In the area of further training, we offer courses on sustainability and Life Cycle Assessments in order to anchor sustainability within the workforce.

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"CO_2 is the currency of the future."

Prof. Dr. Stephan Krinke,
Head of Department at Fraunhofer IST

SUSTAINABLE DEVELOPMENT GOALS

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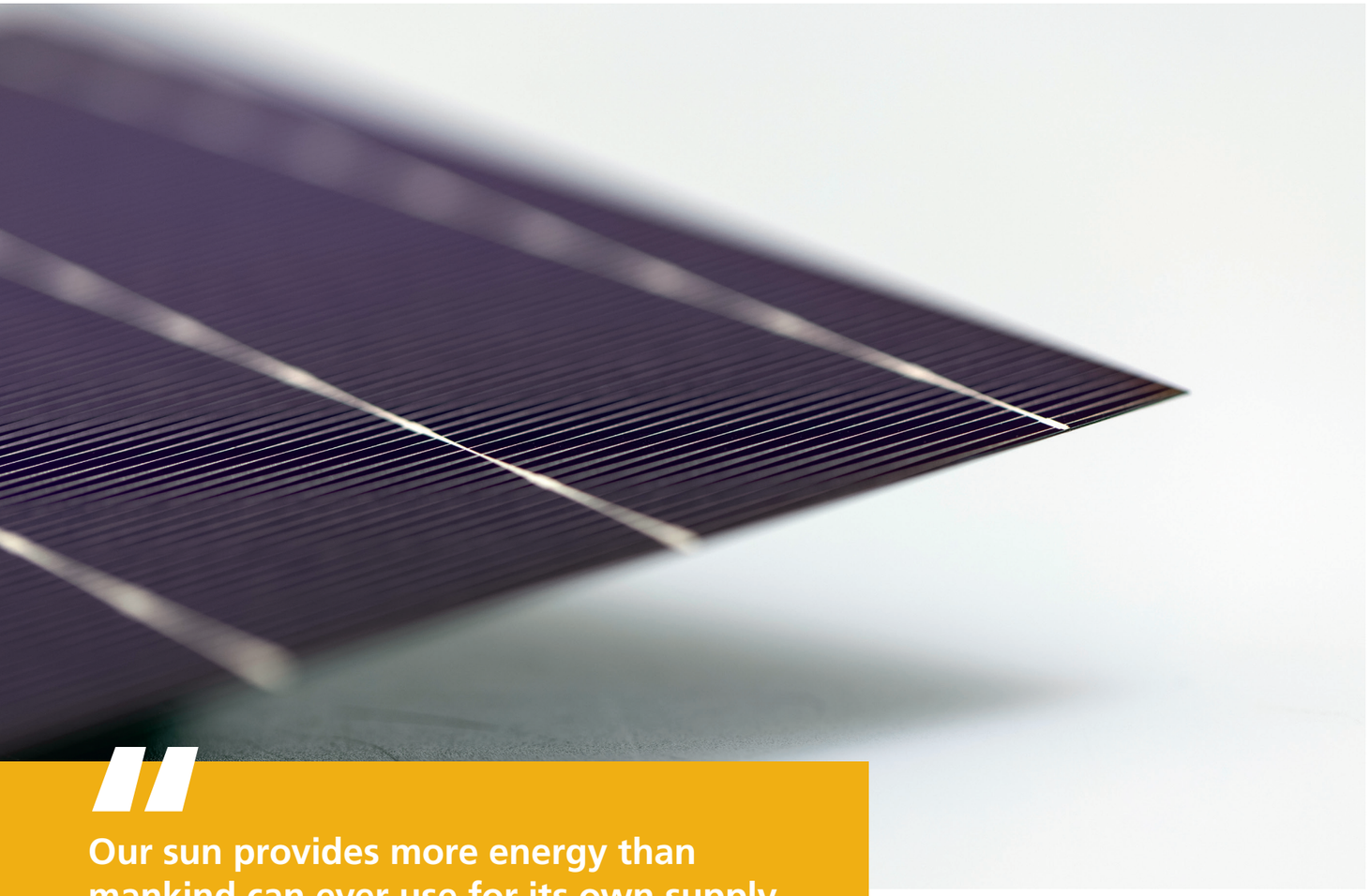

Our sun provides more energy than mankind can ever use for its own supply. The development and provision of technologies for utilizing this free energy source is crucial for our future.”

Dr. Volker Sittinger, Head of Department at Fraunhofer IST

Silicon layers produced by hot wire CVD for a heterostructure solar cell.

The future energy supply for the world will be based on photovoltaics and wind energy. Thanks to silicon-based solar cells, photovoltaics is now one of the most economical sources of electricity worldwide, depending on location.

According to the World Energy Outlook 2020 published by the International Energy Agency IEA, the cost of generating electricity from photovoltaics in Europe lies between 2.7 and 5.4 €ct/kWh for large-scale greenfield installations[2]. Highly efficient solar cells are therefore strategically one of the most important optoelectronic components of the future.

The latest generations are based on the application of vacuum technology for the creation of virtually defect-free interfaces with optimized optoelectronic adaptation to the photovoltaic absorber.

The further development of cell technology towards higher efficiencies is necessary in order to facilitate a reduction in the electricity generation costs, material costs and, as a result, area-related scaling effects. Promising new cell technologies are presented by tandem solar cells based on established silicon and CIGS technologies in combination with perovskite as an additional absorber material. Tandem solar cells have a very complex structure.

They are comprised of a large number of wafer-thin contact layers that are deposited under, between and on the two absorbers. At the Fraunhofer IST, we have acquired extensive expertise in the field of vacuum technologies, which we apply here in order to realize highly efficient processes and, at the same time, excellent layer properties for e.g. transparent conductive layers, tunnel and front contacts or hole and electron contact layers.

The scaling-up of the technologies forms a further focus of our work. Our customers and partners benefit not only from our expertise in the development of layers for photovoltaics or in simulation for process optimization, but also from our measurement technology for quality assurance and control. Furthermore, we carry out Life Cycle Assessments and design the entire product life cycle with regard to sustainability within the scope of our Life Cycle Engineering.

[2]IEA World Energy Outlook 2020, p. 238, https://www.iea.org).

Photovoltaics

The energy transition is crucial for a secure, environmentally friendly and economically successful future. It can, however, only succeed if energy generation, conversion and storage technologies are made even more efficient, cost-effective and environmentally friendly. Essential for this is the holistic and sustainable design of the production systems and life cycles of current and future energy storage systems.

Batteries

For the achievement of these overarching goals, aspects such as the establishment of European gigafactories for the production of battery cells, the energy-efficient operation of these factories, the provision and extraction of raw materials under ecological, economic and social aspects, compliance with the European Battery Directive and the transfer of production concepts to future battery chemistries, etc. are of crucial importance.

Would you like to expand your knowledge in the field of battery research, or do you perhaps have a specific inquiry?

In our further-training program “EPR for Batteries” (Extended Producer Responsibility), you will acquire basic theoretical knowledge regarding the entire life cycle of a battery, including the legal framework conditions. Furthermore, the further-training program was developed in cooperation with the Stiftung GRS Batterien und GRS Service GmbH and therefore also includes topics such as the collection and safe storage of used batteries. In a concluding face-to-face workshop, the requirements and responsibilities of individual decision-makers are discussed in order to successfully transfer the acquired knowledge into practice.

Electrodes for the production of battery cells.

“High-performance, sustainably produced battery storage systems are key technologies for a low-carbon energy infrastructure and a clean future.”

Dr.-Ing. Jutta Janßen, Head of Education Management for Circular Production at Fraunhofer IST

Hydrogen

“You too can become a hydrogen expert by taking part in our training program.”

**Prof. Dr.-Ing. Sabrina Zellmer,
Head of Department and
Deputy Director of the Fraunhofer IST**

The hydrogen economy is a key element in the defossilization of the global energy system and promotes the achievement of the UN’s Sustainable Development Goals.

In the future, hydrogen will be used in the industrial, energy and transportation sectors in applications in which direct electrification is not feasible, e.g. as a reducing agent in the steel industry or for the production of methanol and ammonia. Less than 1 percent of today’s hydrogen demand of 95 million metric tonnes is based on climate-friendly production routes. The International Renewable Energy Agency IRENA predicts an increase in future demand to around 614 million tonnes by 2050[3]. The focus lies on electrolyzers in order to produce green hydrogen using electricity from renewable energies. In addition, a global market for hydrogen and its downstream products is being based on the differing generation potentials from renewable energies.

The Fraunhofer IST offers solutions for a sustainable hydrogen economy. These include processes for the production and recycling of electrolyzers and fuel cells.

In addition, the institute offers digital planning tools and evaluation models for the economic application of hydrogen technologies in factory systems and for the supply of hydrogen via regional and intercontinental supply chains.

Participation in our further-training program will equip you with comprehensive expertise and the skills needed to support the transition from fossil fuels to climate-neutral alternatives. Following completion of the further-training program, you will be able to apply the technical and regulatory expertise regarding the creation of green hydrogen. You will be in a position to identify the requirements and challenges arising through the transition to green hydrogen and to transfer these to a range of applications. You will also be able to outline a hydrogen production system and to describe the fundamental challenges of planning and technical operation. This qualification will enable you, as a pioneer of decarbonization, to actively contribute towards the transformation of the coal regions in Central Germany.

[3]IRENA (International Renewable Energy Agency)

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