PRESS RELEASE

Laser technologies for the future of the hydrogen sector

On September 10 and 11, 2024, the 5th Laser Colloquium Hydrogen 2024 - LKH2 brought together around 60 renowned experts from industry, science and research. The now well-established conference is the ideal platform for discussing the latest developments and applications of laser technology for fuel cell and hydrogen production. At the Fraunhofer Institute for Laser Technology ILT in Aachen, the two-day event focused on the continuous production of metallic bipolar plates, process monitoring and the functionalization of surfaces.

"With laser technology we can meet the challenges of the hydrogen sector in a sustainable and efficient way," explained Dr. Alexander Olowinsky, head of the Joining and Cutting Department at Fraunhofer ILT and host of the event. "Laser technology can play a key role in developing innovative solutions for the industrial production of fuel cells and electrolyzers."

The 17 presentations at this year's LKH2 covered various aspects of the industrial production of fuel cells and the laser technologies used along the entire process chain. In his presentation, Tobias Keller from Fraunhofer ILT explained the advantages of laser technology in the processing and structuring of bipolar plates to maximize the efficiency and durability of these components. "The structuring and optimization of bipolar plates are decisive steps towards more powerful and cost-efficient fuel cells." Keller highlighted the importance of roll-to-roll production, which allows materials to be processed more efficiently and cost-effectively.

Prof. Dr. Eike Hübner from the Fraunhofer Heinrich Hertz Institute HHI demonstrated how laser-induced nanostructures can significantly improve the surfaces of fuel cells, for example as nanofoams. These nanoforms have a high porosity and a large surface enlargement, both of which make them interesting for various applications. "Laser-induced nanoforms significantly enlarge the surface area by a factor of 3000 compared to conventional structures." said the professor.

Laser-based processes as a driver for hydrogen technology

Ultrashort pulse lasers (USP), with which such nanostructures can be produced, offer further considerable opportunities. Stoyan Stoyanov from Fraunhofer ILT explained how USP lasers can be used to generate complex cutting contours in bipolar plates (BPP), such as gas and cooling water inlets and outlets. Dr. Steffen Berger from Schaeffler AG

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also focused on the laser processing of metallic BPPs with USP lasers in his presentation. They enable precise processing of filigree structures in the µm range with minimal material change and high repeat accuracy.

Dr. Martin Müller from Forschungszentrum Jülich emphasized the importance of electrolysis in the hydrogen production process and pointed out that the key to increasing efficiency lies in improving the materials used. He explained the development of new electrode structures and their catalysts, which are used in electrolysis and in fuel cells.

The presentation by Dr. Simon Britten from Laserline showed how diode lasers can be used more efficiently and precisely for various industrial processes, particularly in electrolysis and in the production of fuel cells. "When laser technology is used in the drying process, we can save about 20 to 30 percent in operating costs."

Cross-border networks for the hydrogen sector

An important part of the conference was the exchange on international cooperation, which is essential for developing hydrogen technology further. In her presentation, Dr. Dina Barbian from the eco2050 Institute for Sustainability emphasized the need for global cooperation to overcome the challenges of sustainable hydrogen production. She emphasized the importance of cooperation between countries with different resources to make both hydrogen production and transport infrastructures more efficient.

Robert McConville from Hysata Pty Ltd in Unanderra, Australia, presented a good example of international cooperation. He was connected live from down under: Hysata wants to use its capillary electrolyzers to supply the world's cheapest green hydrogen in the future. "This project demonstrates the importance of international cooperation in overcoming major technological challenges," emphasized McConville. Such collaborations not only promote technological innovation, but also drive the development of infrastructure for the production, transportation and storage of hydrogen worldwide.

Innovations for industrial fuel cell production

Heiko Baumann from the Fraunhofer Institute for Production Technology IPT explained the progress made in the transportation and, above all, storage of hydrogen. Dr. Michael Rhode from the Federal Institute for Materials Research and Testing, Berlin, also spoke about the challenges involved in manufacturing electrolyzers, fuel cells, storage and distribution systems. "Hydrogen has very specific requirements for materials, particularly in terms of corrosion resistance and temperature changes."

Dr. Benjamin Hertweck from Hugo Kern und Liebers spoke about laser welding and punching techniques to increase efficiency in the production of fuel cells. In his presentation, Richard Steinbrecht from Lessmüller Lasertechnik in Munich emphasized the importance of continuously monitoring laser processes to detect defects in production at an early stage. "At the end of the day, it all comes down to the precision of the bipolar plate," emphasized Stefan Kaiser from ANDRITZ Kaiser GmbH.

Precise and efficient laser welding techniques can improve the quality and consistency of joints, which is particularly important for the delicate structures of BPPs. Even the smallest errors in production can significantly reduce performance. "Defects such as melt accumulation along the weld seam are more common at high speeds – process monitoring allows us to detect and rectify these at an early stage," explained Elie Haddad from Fraunhofer ILT.

Laboratory for practice-oriented research and industry cooperation

After guided laboratory tours of the Fraunhofer ILT on Tuesday morning, the participants explored the HydrogenLab in the afternoon. The laser institute has created optimal conditions there to develop the fuel cell from the basics to series production. The environment of the HydrogenLab not only is oriented to conduct practical research, but also designed for interdisciplinary collaboration and offers optimal conditions for public projects and industrial cooperation.

"Once again, this year's LKH2 has shown that cooperation between institutes and companies is essential for mapping the entire production and process chain in hydrogen technology," summarizes Alexander Olowinsky. "The laser processes from tool technology to cutting and welding to surface functionalization also play a decisive role, especially in terms of energy consumption, I am already looking forward to reports on progress and new applications in the coming year."

Images

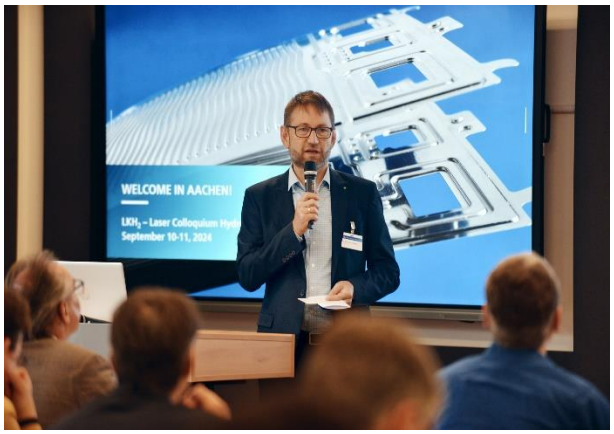

Image 1:
"Laser technology offers us the opportunity to master the challenges of the hydrogen sector in a sustainable and efficient way," explained Dr. Alexander Olowinsky, head of the Joining and Cutting Department at Fraunhofer ILT and host of LKH2.
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Image 2:
The Laser Colloquium Hydrogen offers plenty of space for networking and knowledge exchange. Technical topics are discussed in depth during the breaks and new contacts are made.
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Image 3:
The laser colloquium provided in-depth insight into the current state of research, the performance spectrum and the possible applications of laser technologies in fuel cell production.
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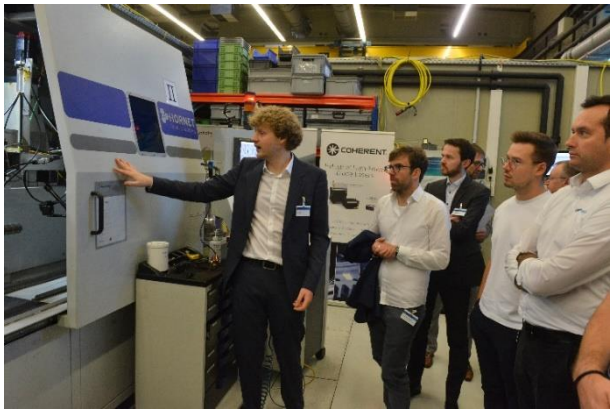

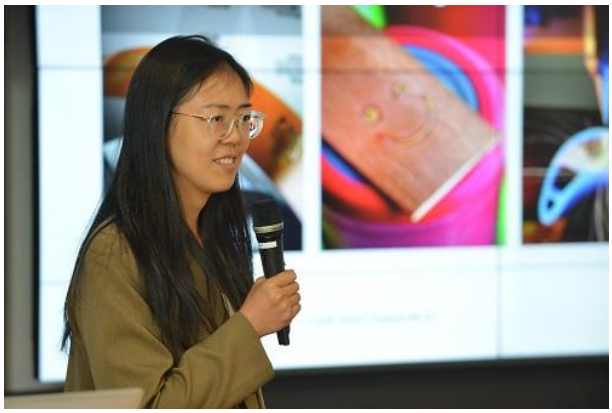

Image 4a & 4b:
During the lab tour, Eduard Weisser (left) gave a clear demonstration of what he explained in his presentation together with Dr. Yingwei Wu (below) about extreme high-speed laser cladding (EHLA). This allows metal surfaces to be provided with high-strength protective coatings that protect against hydrogen embrittlement and thus increase the service life and safety of components.
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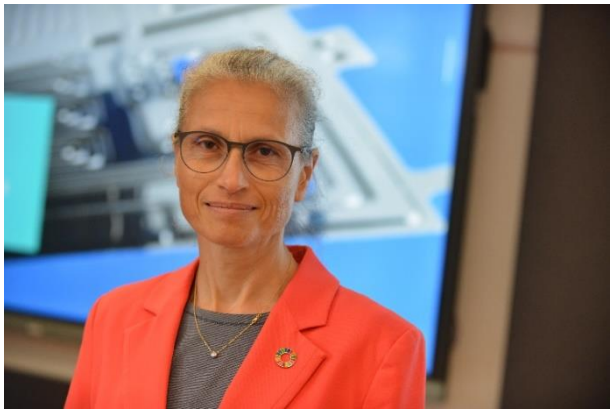

Image 5:
Dr. Dina Barbian from the eco2050 Institute for Sustainability in Nuremberg emphasizes: "We need a rapid transition from fossil fuels to renewables energies and the expansion of the hydrogen infrastructure."
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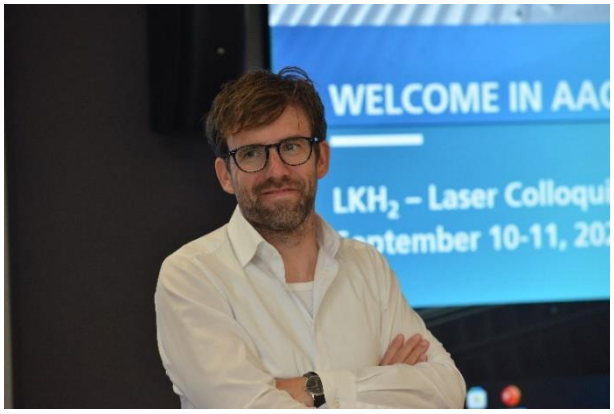

Image 6:
Dr. Benjamin Hertweck from Hugo Kern und Liebers in Schramberg spoke about laser welding and punching techniques for increasing efficiency in the production of fuel cells.
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Image 7:
In his presentation, Dr. Steffen Berger from Schaeffler AG focused on the laser processing of metallic bipolar plates with USP lasers for the precise and efficient processing of these central components in fuel cells.
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Image 8:
Richard Steinbrecht from Lessmüller Lasertechnik explains: "With millions of fuel cells produced worldwide every year, we have to monitor laser processes around the clock to find errors in the micrometer range."
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