

Foreword

Dear friends and partners of IKTS,

with this annual report, IKTS once again looks back on a very successful year. Our total budget is again about the € 80 million threshold, with a very stable earnings situation and, fortunately, growing industry income. Due to the expected difficulties in implementing the SAP system at Fraunhofer level, the exact figures are not yet available; however, this is not critical for us thanks to our positive development. One important point is that we were once again able to invest an amount in the double-digit million range (more than € 11 million) in equipment. This means that we can continue to be available to you as an excellently equipped and competent partner, and offer you the entire value chain of ceramic engineering, including upscaling and non-destructive testing technologies for process monitoring at the highest level. In the field of sensor technology, we are now tapping into “augmented reality” in order to be able to display test results visually with ease. This is of importance with regard to current megatrends, such as the “Metaverse”. A particularly great success is the initiation of a strategic cooperation with South Korea (City of Gumi) in this field. I would like to take this opportunity to thank Prof. Henning Heuer and his team as well as Dr. Tae-Young Han. The activities of Dr. Han in particular have made it possible for South Korea to become our most important partner overseas. We also see high synergies with our Portuguese site, which is closely linked to the Fraunhofer Center for Assistive Information and Communication Solutions AICOS, and has developed very well under its director, Thomas Härtling.

Our activities in the area of storage technologies have been highlighted a few times already. In this field, we have developed into one of the largest institutes of the Fraunhofer-Gesellschaft and are working with the highest scientific and technical depth in all relevant areas regarding batteries and hydrogen systems. With regard to batteries, our activities include e.g. Lithium-ion batteries, solid-state batteries, as well as low- and high-temperature sodium batteries for mobile and stationary applications. This also includes recycling as a topic of interest, which we coordinate for the BMBF under the catchword “green battery”.

An outstanding success in 2022 was the creation of a joint venture for the production of high-temperature NaNiCl_2 batteries between Fraunhofer IKTS (25 %) and Altech Energy Holding GmbH (75 %) – a majority-owned subsidiary of an Australian parent company based in Perth. As part of this joint venture, we are currently building a 100 MW production line in Schwarze Pumpe (Saxony). We have entered into discussions with the Saxon State Chancellery about the acquisition of another 60 hectares of land at the site to be ready to cross the GW threshold in the next stage. Compared with competing technologies, our batteries are characterized by a high level of safety, the use of locally available raw materials and thus lower prices, as well as high cycle stability and a long service life. This gives us the chance to dominate the stationary storage technology market. It also resulted in us winning, once again, the award for the largest industrial project of the year within the Fraunhofer-Gesellschaft. With regard to Altech, I would like to thank the entire team and give praise in particular to Iggy Tan (Executive Group Managing Director), Dr. Uwe Ahrens (Executive Managing Director) and Dr. Carsten Baumeister (CTO). On the IKTS side, this activity is coordinated by Dr. Roland Weidl, how is doing great work with his team.

We would like to repeat such a success this year in the field of fuel cells and electrolysis systems and believe we have the best chances of doing so. For decades, we have been working on high-temperature fuel cells (SOFC – solid oxide fuel cell), which can be used in reverse mode for electrolysis to produce green hydrogen. Compared with other electrolysis systems (alkaline or PEM), these SOE (solid oxide electrolysis) systems have the following unique selling points:

- > 30 % higher efficiency in electricity-to-hydrogen conversion thanks to the utilization of waste heat,
- Co-electrolysis capability, which means in addition to and in parallel with the production of green hydrogen, CO_2 can be reduced to CO in order to produce synthesis gas. This makes SOE particularly suitable for power-to-X processes (e.g. production of e-fuels). SOE is therefore not only CO_2 -neutral, but even CO_2 -negative,
- SOFC/SOE systems are reversible, which means they can be switched between fuel cell and electrolysis mode.

These advantages are crucial for the envisaged hydrogen economy in the context of the Energy Transition. Using our technologies, we now want to start mass production in a timely manner within the framework of industrial cooperation. Our location in Arnstadt is set to play an important role here.

Next to hydrogen technologies, circulatory technologies are playing an increasingly important role at IKTS. One particular focus of this is "Water". Focusing on this topic, we carried out the IKTS evaluation requested by the Fraunhofer-Gesellschaft at regular intervals over the past year. Our strategy of establishing water as an independent business division has been very positively assessed by the Commission. I would like to thank the Commission for the valuable information on the further development of this area. On the IKTS side, and on behalf of the entire IKTS team, I would like to express our gratitude to Prof. Michael Stelter and Martin Kunath for leading the evaluation process.

It is particularly gratifying that we have been able to expand our recycling technologies to the field of "carbon cycles". As part of an effort to reorganize our portfolio, we have acquired the Freiberg-based Fraunhofer research group Circular Carbon Technologies KKT from Fraunhofer IMWS and integrated it into IKTS. The KKT is closely linked to one of the largest institutes of TU Bergakademie Freiberg, namely the chair of Energy Process Engineering of Prof. Martin Gräbner at the Institute of Energy Process Engineering and Chemical Engineering (IEC). We welcome Prof. Gräbner and his team to IKTS and are pleased that we have been able to further expand our cooperation with TUBAF. Last year, I already highlighted the Fraunhofer Technology Center High-Performance Materials THM, which is operated jointly with TUBAF and Fraunhofer IISB. At IKTS, the KKT is a group within the department of Dr. Matthias Jahn, which is now jointly led by him and Prof. Gräbner. KKT focuses on solutions for low-CO₂ and CO₂-neutral technologies for the energy, chemical and raw materials industries. Great synergies are to be had here with our hydrogen and SOE activities, which we are now going to realize.

Ceramic engineering plays an outstanding role in societal mega-issues, such as the Energy Transition, the circular economy and



the security of supply. It must be safeguarded industrially in Europe and globally. We would like to make our contribution – together with you. You can find more highlights and developing trends from our business divisions in this report.

On behalf of the entire IKTS team, I wish you once again a lot of fun perusing this report and some good project ideas. We are looking forward to our mutual cooperation.

Yours,

Alexander Michaelis
April 2023