

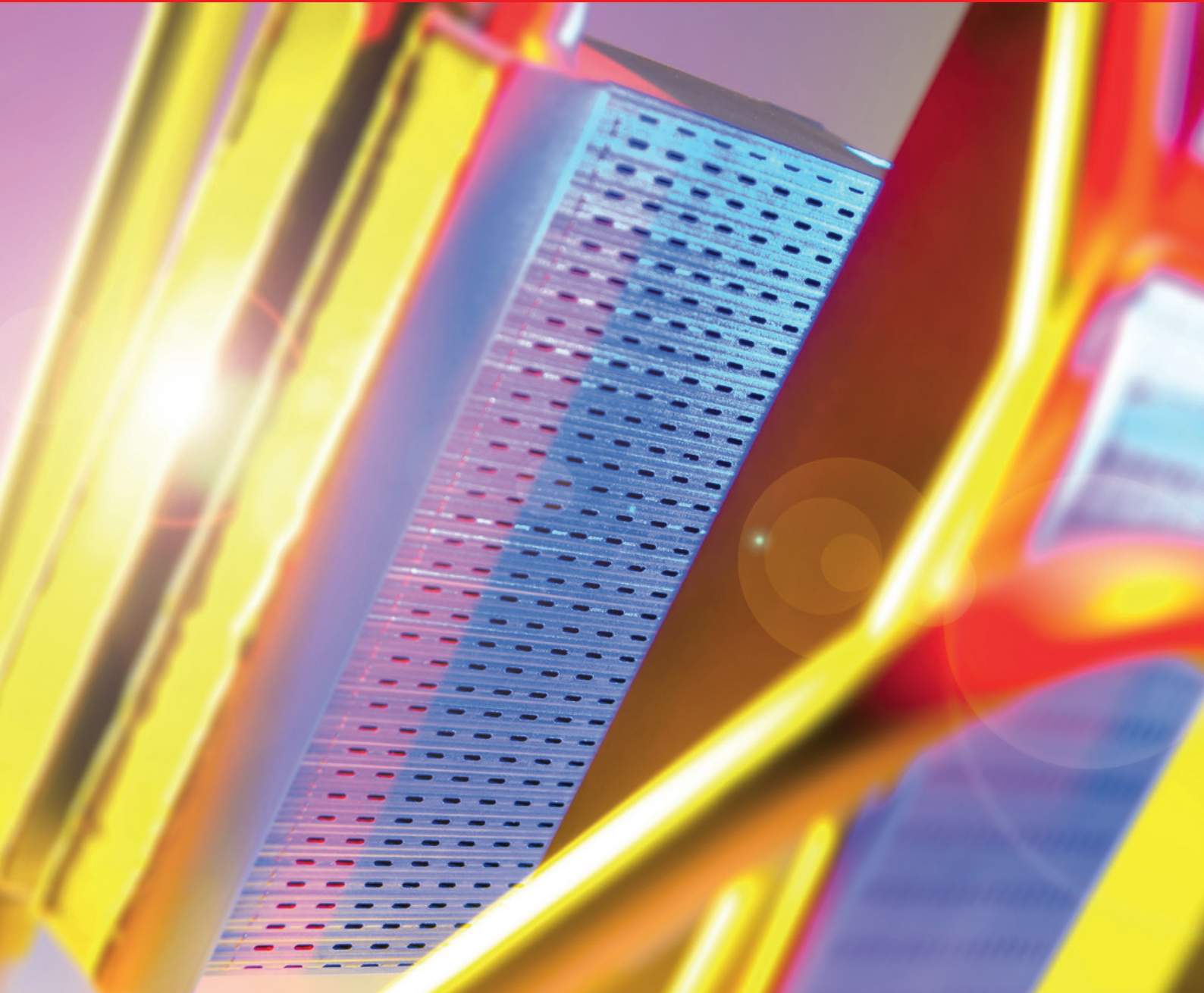


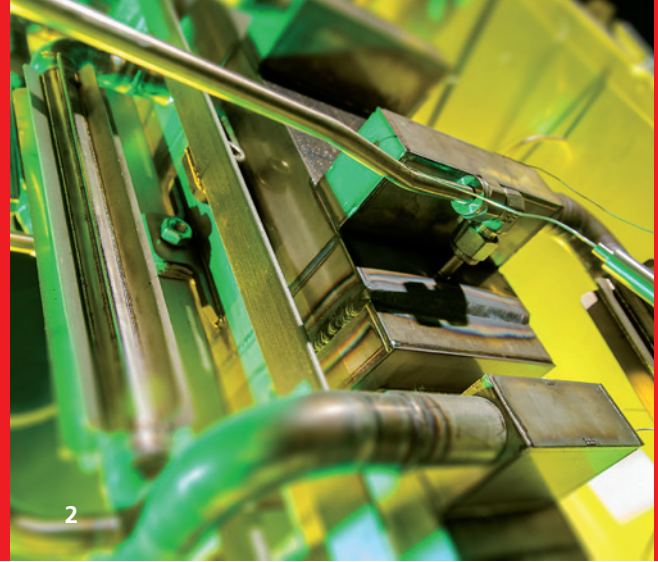
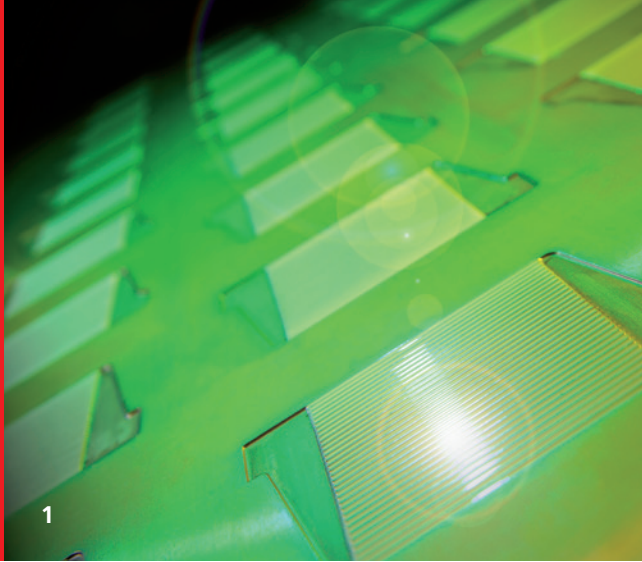
Fraunhofer

ICT – IMM

FRAUNHOFER INSTITUTE FOR CHEMICAL TECHNOLOGY ICT, BRANCH ICT-IMM

DECENTRALIZED AND MOBILE ENERGY TECHNOLOGY





ENERGY TECHNOLOGY BASED ON MICROTECHNOLOGY

The Decentralized and Mobile Energy Technology Department at Fraunhofer ICT-IMM develops energy systems of the future. Besides the development of reactors and complete reformer systems for conventional and regenerative fuels, we also work in the fields of liquid hydrogen technology, heat management, air conditioning systems and synthetic fuel synthesis.

Catalyst Development and Durability Testing

We have gained expertise in the preparation of catalyst coatings onto microchannels by wash-coating. Our catalyst development efforts have resulted in numerous catalyst formulations designed for reforming, catalytic combustion and CO clean-up, which have successfully passed 1,000 hours durability tests. An automated screen printing technique has been developed for mass production of coated metal foils.

Process Simulation, System Design and Control

Modelling and simulation are performed for efficient and optimized reactor and system design. We carry out static and dynamic ASPEN-Simulations of complete systems such as fuel processors.

System Integration and Testing

Our laboratories provide modern analytical equipment such as on-line gas-chromatography, mass spectrometry and FT-IR spectroscopy. Nine test benches are available for catalyst evaluation. Reactor and complete fuel processor testing is performed in dedicated test benches for the size ranges below and above one kilowatt. Modern CAD software, CFX simulation

and ASPEN Dynamics modelling tools assist our physicists, chemists and chemical engineers in creating and designing tailor-made solutions for our customers.

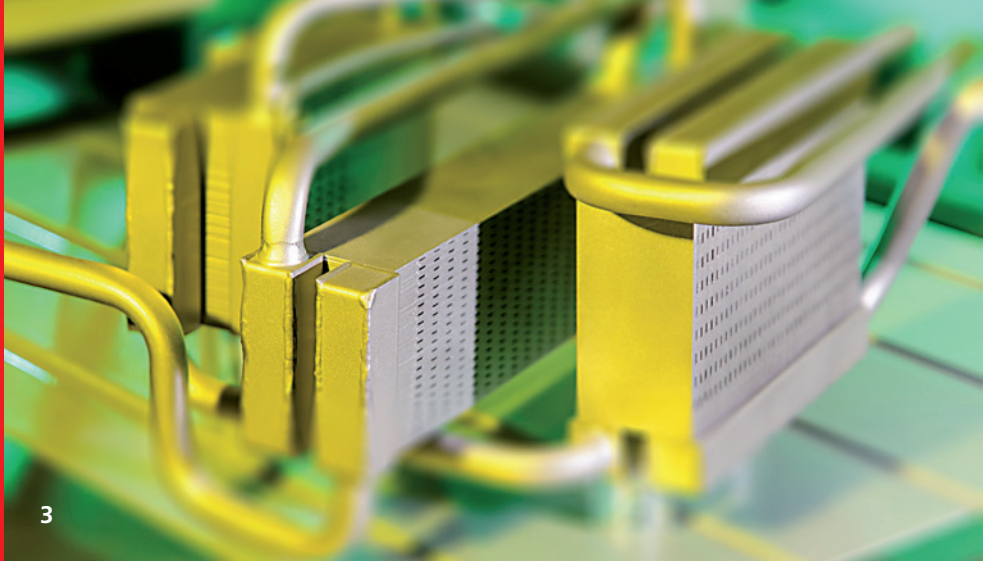
Components, Reactor Fabrication and Testing

We have developed a large variety of microstructured reactors for processing of various fuels such as methanol, ethanol, propane/butane (LPG), gasoline and diesel. The power range covered reaches from 30 W to 100 kW plus to date and operating temperatures from 100 °C to 900 °C. Thermal management of the reformers and CO clean-up reactors is a critical issue. One of our reactors, developed for a laboratory exhaust cleaning process, has recently passed its 35,000 hour operating milestone. The plate heat exchanger technology applied makes the devices highly compact, efficient and allows the integration of multiple functions.

Development of Cheap Fabrication Technologies

Reactor fabrication applies cost-efficient production techniques such as etching, embossing and laser welding. A 1 kW CW fiber laser is available at Fraunhofer ICT-IMM for reactor sealing.

- 1 Etched microstructured plates for screen printing.
- 2 Example of reformer system.
- 3 250 W LPG fuel processing system.

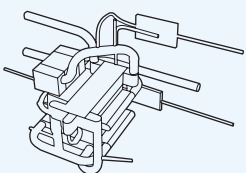


FUEL PROCESSING AND HYDROGEN GENERATION

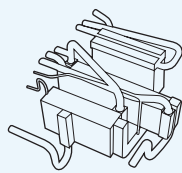
The integration of the fuel processor components to a complete, thermally integrated fuel processor is a critical step towards a marketable product. Compactness, maximum efficiency and low start-up time demand are major targets. We perform static and dynamic ASPEN-Simulations of complete fuel processors to achieve these targets.

Microtechnology offers enormous advantages in size reduction, efficient utilization of heat sources and catalyst as well as start-up strategies. Moreover, we can assist our customers in choice and integration of balance-of-plant periphery required to move and control the flow of feed components to the system.

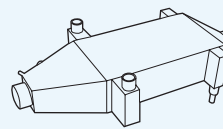
We develop reformer systems from 100 W to 20 kW and upwards



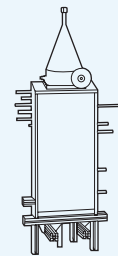
**130 W
Methanol Reformer**



**250 W LPG
Fuel Processor**



**5 kW
Water Gas Shift**



**20 kW
Fuel Processor
for Methanol**

CORE COMPETENCIES

We can provide you with all services required for component and system development.

- Feasibility studies
- Dynamic system modelling
- System testing
- Prototype design and manufacturing
- Catalyst development
- Detailed engineering
- Catalyst stability testing
- Basic engineering
- Reactor testing

Our microstructured components and services are used for manifold application areas.

- Aerospace
- Decentralized energy generation
- Heat management
- Heavy goods vehicles
- Bio-compatible reactors
- Exhaust gas purification
- Recreational vehicles
- Tank inertization

Contact

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