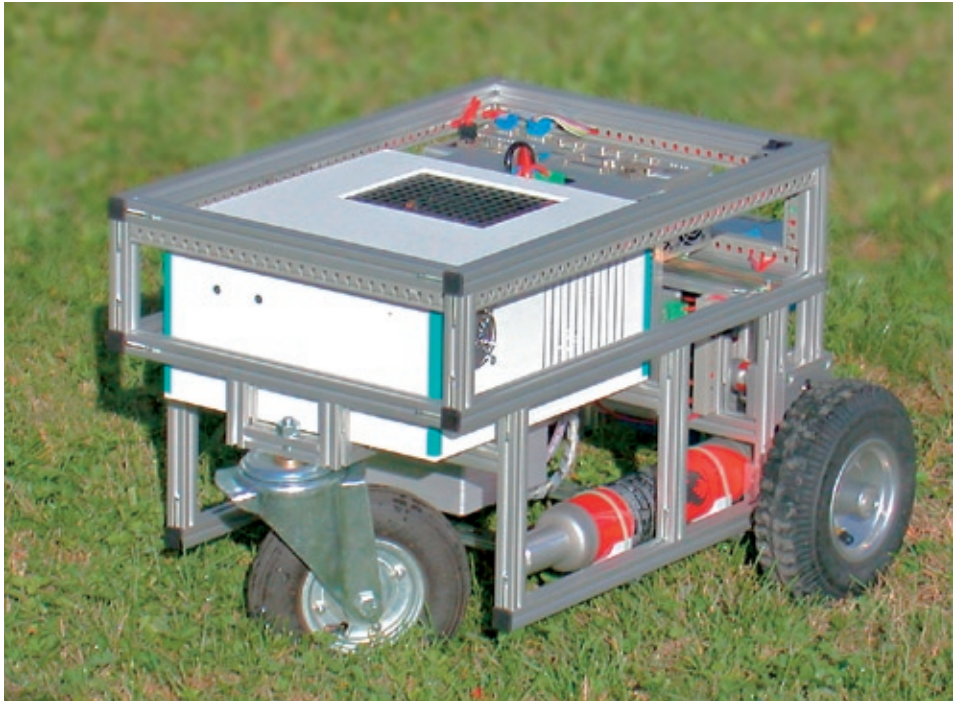




Portable Fuel Cells – Electricity without cables



Service robots, as shown above, require long periods of autonomous power. Fraunhofer ISE has developed a powerful 350 W_{el} fuel cell system that operates on hydrogen.

Feel free to ask!

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Grid-independent electricity supplies, e. g. telecommunication systems, signal systems, measurement stations or electrically-powered bikes are in great demand on the market. Especially in the field of service robotics, power supplies enabling long operating times are desired.

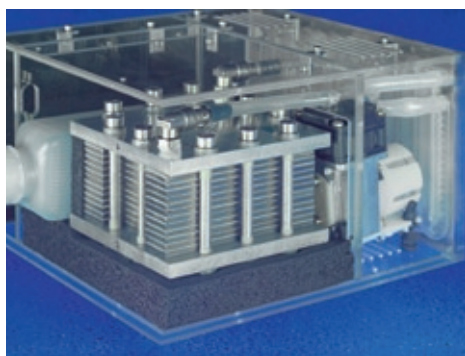
Fraunhofer ISE develops compact and completely automated fuel cell systems in the power range between 10 W_{el} and 500 W_{el}. In particular, we focus on membrane fuel cells which operate on hydrogen, reformat gas, chemical hydrides, methanol or ethanol. Our system technology permits a flexible integration and can be adapted to fit different applications. Our stack concepts guarantee a reliable operation with a long lifetime.

Does your application have special boundary conditions? Our fuel cells can be tuned to fit your specifications on production, electric characteristics and environmental conditions.

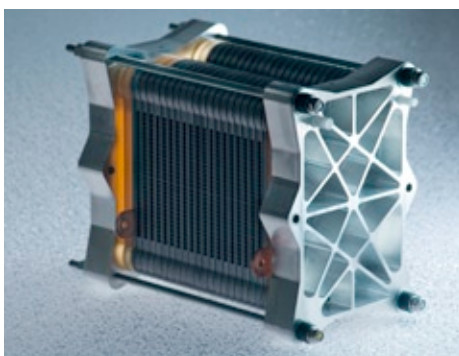
Do you require a robust system control? We transfer our control strategy to fit your electronic platform.

Do you prefer an alternative to hydrogen? No problem. We investigate the use of reformat gas, the use of high-temperature membranes or combine the fuel cell system with a micro-reformer.

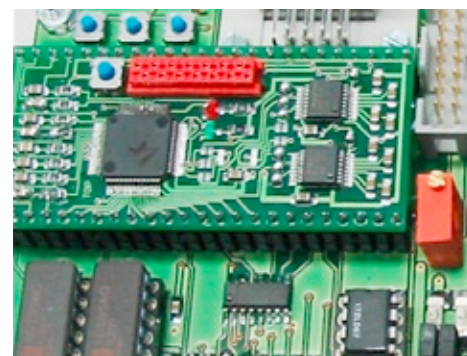
Are you interested in marketing? We are happy to provide you with the exploitation rights associated with our developed stacks and systems.



Direct methanol fuel cell system with internal water recycling for filling with pure methanol.



PEM fuel cell stack with a power of 350 W_{eI} and air-supported single cell cooling.



Control electronics, based on a microcontroller, for fuel cell systems.

Fuel Cell Stacks

At Fraunhofer ISE we develop fuel cell stacks for the low- and high-temperature PEM technology, for direct methanol or direct ethanol systems as well as for use with reformate gas operation. Our various stack concepts are suitable for the power range from 10 W_{eI} through to 500 W_{eI}.

The fuel cells are cooled passively or by using water or air cooling. In addition, we are investigating the use of heat pipes.

A decisive factor for the marketability of fuel cells is a long lifetime. For degradation investigations, we apply gas chromatography for exhaust gas analysis, cyclovoltammetry, ICP-MS to identify the elements in the liquid phases or ESEM with EDX to characterize the membrane electrode unit.

For developing the stack concept, we use CFD simulations, thermal models and validated mathematical models. Further, we make use of spatially resolved characterization of current, impedance and temperature combined with visual considerations of the water transport in the flowfield.

System Technology

An optimal system concept considers both the operating behavior of each component as well as their interaction. Therefore, in developing our components and operating strategy, we take into account the global system requirements.

Dependent on the application, we integrate metal hydride, or pressurized, canisters in the system. Otherwise, we develop hydrogen generators on the basis of chemical hydrides as well as micro-reformers for liquid and gaseous fuels.

We apply our experiences, gained from the construction of numerous, automated complete systems with different power ranges and varying fuels, to choose peripheral components.

Using high-quality fuel cell test stands, we perform load qualification tests on our own developments and on external components. In a climate chamber, we test the operation under temperatures between -40°C and +80°C.

Using system models and automated test stands, we carry out long-term investigations and dynamic load tests. These establish the basis for the development of the controls electronic and safety technology.

Competence

Since the 1990s, Fraunhofer ISE has been carrying out research and development on fuel cells and hydrogen generation. We are continuously active in international research networks and we cooperate closely with industry partners. Fraunhofer ISE is certified according to DIN EN ISO 9001:2000.

Experience and know-how:

- PEM, direct methanol and direct ethanol fuel cells
- Use of fuel cell systems under extreme climate conditions
- Reducing balance of plant
- Applying different manufacturing technologies
- Use of graphite material, polymers and metal materials
- Continuous investigations of commercial materials and components
- Transfer of expertise to numerous suppliers

In reference projects, we have developed fuel cell systems for camcorders, laptops, measurement stations and small propulsion motors.

What can we do for you?