



## Electrolysis – Produce your own hydrogen!



Test of a reversible fuel cell operating as electrolyser.

### Feel free to ask!

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The market for fuel cells is growing annually at rates in the two-digit numbers, and the market vision is becoming reality. On the one side, a large number of companies are concentrating on fuel cell technology. At the same time for specific applications, complete solutions for the fuel supply are still being sought. Electrolysis demonstrates potential for companies wishing to position themselves in the growing market.

Fraunhofer ISE develops membrane electrolysers which generate from one to several hundred liters of hydrogen per hour. Depending on the requirements, high purity hydrogen or oxygen can be generated under normal or high pressure. If desired, we integrate gas or water purification as part of the system. Our systems are fully automated, including the safety technology.

**Does your application have special requirements?** We match the characteristics of our electrolysis system, e.g. pressure, power, water purification, hydrogen and oxygen purification to your specifications.

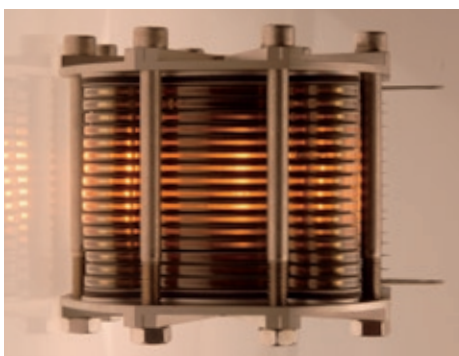
**Do you want to manufacture electrolysers?** We transfer our know-how to your production and qualify suitable suppliers.

**Are you looking for a complete, autonomous energy supply?** We are happy to integrate the electrolyser into a complete system concept with photovoltaics or wind energy, battery, hydrogen storage and fuel cell.

**Are you interested in marketing?** We would be happy to inform you about the exploitation rights and licenses available.



Control electronics for a complete autonomous electrolysis system.



Electrolysis cell stack with injection molding technique



Portable pressure electrolyser with drying unit for filling metal hydride storage

### Technologies

Our different stack concepts manufactured with injection molding or out of titanium range in power from several Watts up to ca. 2 kW<sub>el</sub>.

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

For the gas drying, we implement different procedures such as membrane modules, mole sieves or hygroscopic liquids. The purification of the electrolyser water takes place by means of an ion exchange module.

Based on our experience obtained from constructing numerous, automated, complete systems in different power ranges, we select customized peripheral components. High-quality test stands enable us to perform qualification tests both on our own developments and on bought components. This serves as the basis for the development of the control electronics and the safety technology.

### Reference Projects

As commissioned by the then German Federal Ministry for Research and Technology, we installed and put into operation a pressure electrolyser in combination with a solar generator, hydrogen storage and oxygen storage as well as a fuel cell in the »Self-Sufficient Solar House« in 1992.

We realized a miniature electrolyser encased in a complete system including gas drying, commissioned by Interpane Glasindustrie AG. The system was developed to the point of being ready for production, and it was tested over several thousand cycles.

For over four years now, one of our 2 kW<sub>el</sub> electrolyzers is operating maintenance-free at the »Institut for Energietechnik« in Norway.

For the European Union, we are researching reversible fuel cells that can either be operated as electrolyzers or as fuel cells.

With the support of the former Federal Ministry for Economics and Employment, we have developed a portable electrolyser for filling metal hydride storage canisters for an industry consortium.

### 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 cooperate closely with industry partners. Fraunhofer ISE is certified according to DIN EN ISO 9001:2000.

We foster an intensive transfer of knowledge with our numerous suppliers. High-quality electrolysis test stands enable us to perform qualification tests on our own developments and on bought components.

Experience and Know-how:

- completely automated systems for hydrogen generation
- controls and safety technology
- stack concepts from material selection to flowfield design
- characterization of electrodes
- investigation of degradation effects
- screening of commercial materials and components

**What can we do for you?**