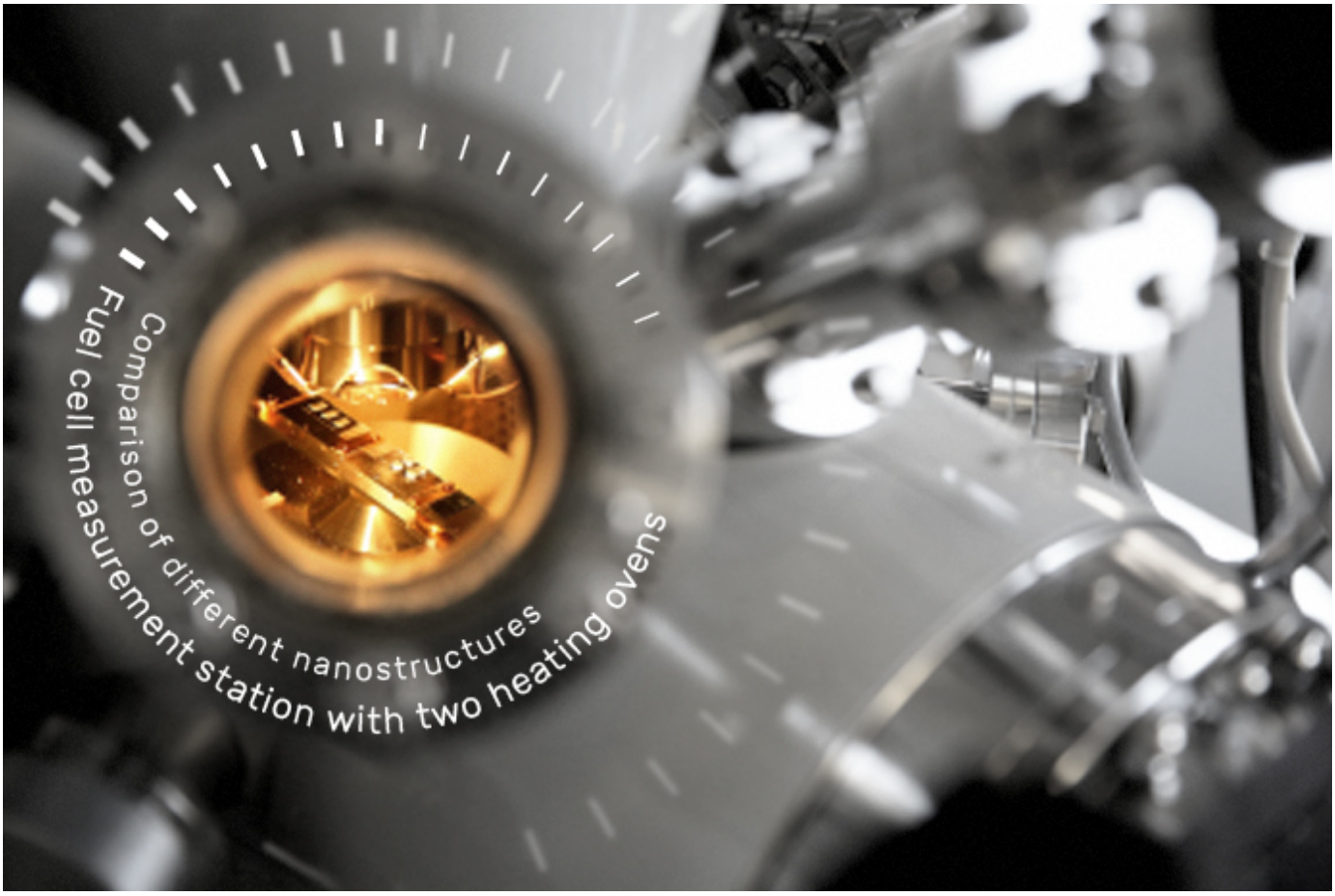
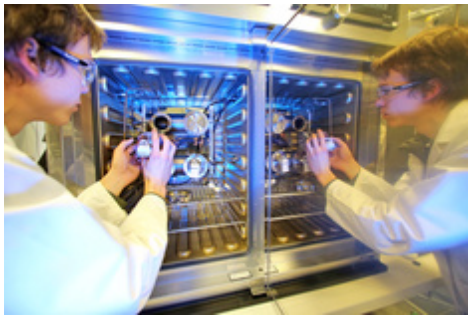


In a fuel cell measurement station at the Leibniz Institute of Surface Modification, two Memmert heating ovens ensure the correct operating temperature for benchmarking nanostructured, three-dimensional composite electrodes.



Fuel cell measurement station at the Leibniz Institute of Surface Modification in

Researchers working at one of the 93 German Leibniz institutes are following big footsteps. The institutes' eponym, the famous Leipzig-born Gottfried Wilhelm Leibniz, is often referred to as the last polymath. Consequentially, facilities doing research on the most diverse subjects, ranging from natural and engineering sciences to humanities, have come together under the roof of the Leibniz society. The Leipzig-based institute for surface modification is, among other things, dedicated to the exploration of electrochemically active surfaces as they can be found in fuel cells.

Leipzig

Functional principle of a fuel cell

Memmert drying oven UF75

In a fuel cell, oxygen reacts with a fuel (e.g. hydrogen) to convert chemical energy to electrical energy. A cell consists of two electrodes separated by an ion conductor (electrolyte) to prevent an unwanted hydrogen-oxygen reaction. Due to the catalytically active platinum layer (in low-temperature fuel cells), the hydrogen supplied at the anode (positive electrode) oxidises into its components. Propelled by the resulting potential difference, two electrons per hydrogen molecule (H2) flow into the external circuit, while two protons (H+ ions) diffuse to the cathode through the negatively charged electrolyte. Under the influence of heat and with the electrons from the circuit and the hydrogen protons, the oxygen supplied at the cathode is reduced to water, which is discharged from the cell as a waste product. Depending on the type of cell and the operating parameters, the actual electrical voltage is between 0.6 and 0.9 volts. A correspondingly higher performance is achieved by connecting several cells in series to a stack. Fuel cells achieve an efficiency of up to 70 %, with the smaller portion of the reaction energy being released as heat.

The quest for an economic fuel cell

Since the 1950s, the commercial use of fuel cells is, among other things, being tested for vehicle-powering applications or to supply buildings with power and heat. Thanks to its relatively high efficiency of up to 70 %, fuel cells are a perennial issue in the discussion on alternative energy sources. Apart from the high manufacturing costs of hydrogen, the high costs of platinum catalysts as well as the currently low efficiency of electrodes are a bar to the wide practical application. From the different types of fuel cells developed and tested in the past, the solid acid fuel cell (SAFC), which functions at medium operating temperatures starting at 230 °C, seems to be the most promising technology. The team headed by Dr. Aron Varga, group leader of electrochemically active surfaces and energy

conversion, predominantly addresses the question of to what extent alternative materials like carbon nanotubes or graph membranes can replace the expensive platinum and palladium catalysts.

Structure of the fuel cell measurement station

The fuel cell measurement station consists of two Memmert heating ovens. In the first oven, the two reactive gases hydrogen and oxygen accumulate water as they pass through two gas-tight water tanks at 80 °C. This step is necessary to stabilize the electrolyte material CsH_2PO_4 during the electrochemical measurement and prevent dehydration at operating temperatures of 150 °C and higher. The reactive gases are led through heated stainless steel tubes into the gas-tight stainless steel tanks containing the fuel cells in the second heating oven. The oven heats the electrochemical cells to a constant 240 °C, which is the operating temperature of the solid acid fuel cell. The main parameters distinguishing the test cells from each other in terms of efficiency and electrode performance are evaluated in a comparative impedance measurement or, put simply, a resistance measurement. For Aron Varga, the durability and usability are the most important advantages of Memmert heating ovens: "Our tests will run for the next five to ten years. That's why reliability and consistent temperature stability are indispensable."

Ageing of wires and cables

At Leoni in Roth, wires and cables are subjected to hard tests during artificial ageing in a Memmert heating oven.

more information

The text of this article is largely based on statements of the Leibniz Institute of Surface Modification in Leipzig.
AtmoSAFE would like to thank Dr. Aron Varga for his kind assistance.

For inquiries on **Memmert custom** products, contact myatmosafe@memmert.com.

Overview of focal topics

- Leibniz Institute of Surface Modification in Leipzig,

Memmert laboratory equipment for material testing

Germany

- Fuel cell
- SAFC solid acid fuel cell
- Memmert heating oven

Climatic test chamber CTC
Constant climate chamber HPP
Climate chamber ICH
Humidity chamber HCP
Heating oven U

Autor: