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MOBILITY & PRODUCTION

Fields of Expertise TU Graz

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Source: Lunghammer – TU Graz

One of the key questions relating to the future of mobility is how to determine the right propulsion technology. Since the answer to this question naturally also represents a decisive framework condition for the production of drive systems, the Mobility & Production Field of Expertise at TU Graz creates a valuable synergy in this regard.

The essential requirements for propulsion technologies are that, instead of fossil fuels, they are based on sustainable energy – in the medium term at least – and that they have no significant negative impact on ambient levels of pollution. In principle, this can be achieved by means of electricity using battery electric drives, hydrogen using fuel cells, as well as e-fuels and renewable fuels using internal combustion engines. Since each of these approaches has advantages and disadvantages, the choice of the right technology depends on the specific application. Within the Mobility & Production Field of Expertise, research is carried out in all of the areas mentioned above, some of which has already been presented in this journal.

At TU Graz, research into hydrogen and fuel cells is also firmly established in several institutes and in the HyCentA hydrogen research centre. The following article presents the extensive research work carried out at the Institute of Chemical Engineering and Environmental Technology on the characterisation and optimisation of fuel cells, and describes recently completed research projects and ongoing dissertations which have a special focus on questions concerning the ageing mechanisms of fuel cells.

Katharina Kocher, Kurt Mayer, Bernhard Marius, Bernd Cermenek, Viktor Hacker, Sigrid Wolf:

Fuel Cells – Materials and Methods for Prolonging Lifetime

Finding the optimal combination of high performance and durability is a key factor in the realisation of future sustainable energy production systems. The research at the Institute of Chemical Engineering and Environmental Technology focusses on the development of highly innovative materials and efficient operation strategies for fuel cells.

New technologies for emission-free energy conversion are needed in the face of the tug of war between environmental protection and the temptations of the consumer world – especially when it comes to electrical and entertainment technology and transport. Fuel cells enable sustainable electrical power generation for mobile, portable and stationary applications. In the case of transport applications, consumers expect the same ranges and speed of refuelling as they get from conventional mid-size vehicles. Long-lasting, active and stable catalyst systems and innovative operation strategies with very low performance losses are required to guarantee the successful commercialisation of fuel cell systems.

CATALYSIS IN FUEL CELLS

By combining hydrogen and atmospheric oxygen, chemical energy is directly converted to electrical energy via an electrochemical redox reaction. The materials currently used for catalysis, carbon and platinum, reach extremely high reaction rates for the hydrogen oxidation reaction at the anode and the oxygen reduction reaction at the cathode; kinetically ingenious but thermodynamically instable and too costly over the long term.