Contribution ID: **144** Type: **Contributed**

Catalytic Performance of Coated Hollow Glass Microspheres

Wednesday 20 June 2018 11:30 (20 minutes)

Hydrogen can be stored in a hybrid system consisting of hydrogen pressurized hollow glass microspheres (HGMS) and a hydride, e.g. NaBH4. Storage involves heating and pressurizing the spheres at approx. 85 MPa, forcing the gas into the them. Hydrogen is released by heating again to approx. 250℃. To reach this temperature the exothermal chemical reaction of NaBH4 with water, which produces hydrogen as a welcome by-product, is used. To promote the reaction the HGMS (diameter approx. 20 µm) have to be coated with a catalyst. The catalyst coating on the HGMS is deposited using a special coating device based on non-reactive (for metals) and reactive (for non-metals) magnetron sputtering. It provides continuous intermixing of the fragile spheres in a container by a combination of rotation and concussion. It is possible to produce extremely homogenous coatings on single spheres as well as on ensembles with volumes up to 100 ml.
The catalytic reaction is tested in a set-up which measures the released heat and amount of hydrogen. For a two layer film architecture which consists of an adhesion promoting film of reactively sputtered TiO2 and a reactively co-deposited film of Ru and TiO2 the theoretical maxima of released heat and hydrogen could be achieved in a first run. This special film architecture was chosen because pure Ru, despite also exhibiting excellent catalytic properties, delaminated from the microspheres after performing the catalytic reaction. To test the durability of the two layer system, more catalytic runs were performed on the same sample. It could be shown that catalytic activity was still present at the fourth re-use, if the catalyst coated spheres were cleaned properly from reaction products by exposure to an acidic environment. The coatings sustained all cleaning steps and only showed minor signs of delamination, so that they can be considered to be usable also for even more catalytic cycles.

Primary author: Dr CHRISTOPH, Eisenmenger-Sittner (Vienna University of Technology)

Co-authors: Dr DREXLER-SCHMID., Gerwin H. S. (Austrian Institute of Technology); Dr EDER, Andreas (Vienna University of Technology); BÖHM, David (Vienna University of Technology); GIPARAKIS, Miriam (Vienna University of Technology); PLANITZER-REHM, Susanne (Vienna University of Technology)

Presenter: Dr CHRISTOPH, Eisenmenger-Sittner (Vienna University of Technology)

Session Classification: Thin Films & Surface Engineering

Track Classification: Thin Film & Surface Engineering