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Research area: Product aims

Paper, paperboard and board // technical specialty papers

Key words:

Metal paper, PEM-electrolysis, renewable energy

Title:

Ti-Paper-Electrode – Development of porous paper-based Titanium-electrodes for PEM-Electrolysis

Background/Problem area

The production of hydrogen via electrolysis is a forward-looking method to store renewable energy. Concerning performance, installation engineering and maintenance is the PEM-electrolysis (Polymer-exchange-membrane) a competitive process to the well-established KOH-electrolysis. The industrial occurrence of this technology requires cost-efficient electrolysis systems. State-of-the-Art power distributors in such PEM-cells are based on Titanium (sintered materials or webs), are very expensive and so far not optimized for this special application. Based on the "Paper-derived powder metallic materials" which PTS developed together with the Fraunhofer IFAM, it is possible to convert highly metal filled papers into porous metal structures. Using titanium-hydride (TiH₂) it is also possible to obtain a porous titanium material. Based on this approach it should be possible to develop a function-optimized, cost-efficient power-distributor to be used in PEM-Electrolysis-cells.

Objectives/Research results

The work will start with choosing and characterization of available titanium-hydride-particles. Possibly available powders need to be grinded down to proper particle sizes <30µm. The paper development will focus on high filler content, homogeneous formation and adjustable porosity (by means of fiber content, particle sizes). Retention rates <99% are aimed to avoid any migration of TiH₂ in process water. The lab papers will be characterized concerning mechanical strength, roughness and pore size distribution. Paper lab-sheets will be used to investigate the de-binding and sinter parameters for this material in small-scale. In cases of cracking or inhomogeneous sintering the paper recipes will be further improved in a second lab cycle (e.g. by calendering). First functional tests will be done by ZBT in Duisburg to estimate the performance of the material. It needs to be investigated how thickness, porosity and pore size of the sintered material influence the effectiveness of the power distributor within the PEM-cell. Not till then further material optimization can be realized. Up-Scaling trials on the pilot paper machine will be done with optimized recipes.

Application/Economic benefits

Possible applications of PEM electrolyzers range from small laboratory gas generators to decentralized hydrogen generators for hydrogen fueling stations and central gas production units for so-called power-to-gas applications for the storage of excess power generated from renewably resources.

Period of time: 01.05.2017 – 31.10.2019

Remarks

The research project IGF 19526 BG is done in cooperation with the Fraunhofer IFAM Dresden (Fraunhofer Institute for Manufacturing Technology and Advanced Materials) and the ZBT Duisburg (The hydrogen and fuel cell center) and is funded by the German Federal Ministry of Economic Affairs and Technology (BMWi) within the "research alliance energy revolution" AiF.