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Structure and Properties of 316L Sinter Paper for Use as Gas Diffusion Layer in PEM Fuel Cell Applications

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A manufacturing process derived from paper technology can be used to produce a flat porous metallic material. To this end, organic fibers, fillers and additives are mixed with metal powder and the pulp is subsequently processed on a paper making machine. The so-called green paper is then subjected to a heat treatment where the organic components are removed. After that, the remaining sheets are sintered at temperatures close to the melting point of the metal powder, resulting in a purely metallic porous material, the so-called sinter paper. This approach has been used for the development of an innovative Gas Diffusion Layer (GDL) for mobile fuel cells. GDLs are situated between the bipolar plate and the electrode inside the fuel cell stack. They ensure optimal gas distribution as well as the removal of water, heat and electricity and have therefore to comply with complex requirements with regard to electrical conductivity, mechanical properties, as well as wetting behavior and fluid flow properties.

So far, metallic sinter paper that meets the materials specification of stainless steel 316L could be made. The thickness of the paper is around 200 μm , and the porosity of the base material reaches values of approximately 60 %. A thorough morphological characterization was carried out based on high-resolution μCT scans and analyzed via the software package GeoDict. Measured and calculated values of the electrical and heat conductivity have been compared and first measurements of the electrochemical performance in a single-cell test bench have been carried out.

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References

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