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Improvement of electrical conductivity of bipolar plates for fuel cells by surface plasma modification

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Fuel cells are one of the promising alternative energy sources nowadays due to their ecology, reliability, durability and ease of operation. However the implementation of this technology is not easy, due to challenges in the fabrication process. One of such problems is the enhancement of the electrical conductivity of compound based bipolar plates (BPP) for hydrogen fuel cells, because of the commonly use of intrinsic insulating plastic matrix material like PP that is enriched at the surface of the BPP during the manufacturing process. Established techniques like milling and sand blasting are suitable to remove the PP, which is situated mainly at the surface of the BPP, plasma treatment of the surface is used in this work to selectively etch the PP from the surface to improve the conductivity and offers new potential to reduce the cycle time regarding the post treatment. A special microwave plasma source is used in remote mode (CYRANNUS by iplas) that allows plasma treatments up to atmospheric pressure, making the process fast and scalable for industrial applications. In this work we will demonstrate the effect of plasma treatment of BPP for hydrogen fuel cells – optimization of the surface properties, according to the objective to improve the electrical conductivity of the BPP, and investigate the physical and the chemical processes and changes on the surface. The surfaces of the plasma-treated BPP were investigated using SEM as well as FTIR and Raman-Spectroscopy and the effect of different gases under different plasma conditions were measured. The results showed significant reduction of the PP as well as the etching of nanocrystalline graphite at the surface by plasma treatment, whereby the general conductivity reached the required values.

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