Enhanced Mass Transfer Properties of Porous Nickel Foam as Flow Field for Fuel Cells under Different Working Conditions

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High-porosity metal foam, with the advantages, such as low price, good electrical and thermal conductivity, performs high performance as flow field for fuel cells. The mass transfer properties of porous metal foam (PFM) flow fields were investigated under different working temperature and humidity conditions. Fuel cells with both of PFM1 and PFM2, with the area density of 765 and 1500 g·m⁻², respectively, maintained high performances at various states; comparatively that with serpentine flow field (SFF) showed obvious voltage drops at dry and flood state. The area density influence was also discussed, and PMF2 released the largest power density of 96.7 mW·cm⁻², which is 157% of SFF. Its mass transfer ability was further studied in flooding situation, with 34% of the flow field volume occupied with water. The porous structure not only enabled the PMF flow field well anti-flood ability, but also the extra water stored in the pores could humidify the membrane at dry state.

Keywords: Fuel cell; Metal foam flow field; Humidity; Area density.

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