Gas diffusion electrode hydrophobicity: A factor influencing the efficiency of alkaline fuel cell

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Gas diffusion electrodes (GDE) are types of porous electrodes. GDEs provide three phases of contact between gas, liquid and solid catalysts on GDE without mixing these phases to each other and electric conductivity. The penetration of phases through GDE can be prevented by the addition of hydrophobic substances e. g. PTFE (polytetrafluoroethylene) to the catalytic layer. A high level of PTFE decreases the penetration phases through GDE, but it decreases the efficiency of the AFC (alkaline fuel cell). For AFC GDE is in the contact with a liquid solution of KOH and gas: hydrogen or oxygen. GDE can be prepared from commercial GDL (gas diffusion layer) and the catalytic layer is applied on GDL by several methods e. g. ultrasonic spray deposition.

This work aims to determine the ratio of PTFE to platinum catalyst (40 wt. % Pt/C) in the catalytic layer (Pt load was 0.5 mg/cm^2). Electrodes were prepared with different ratios of PTFE to catalyst on commercial GDL from 5 wt. % to 60 wt. % PTFE. The contact angle of GDE represents the rate of hydrophobicity of GDE. The level of hydrophobicity is a significant factor for the right operation of the alkaline fuel cell (AFC). Electrodes were tested in temperatures 25 °C and 40 °C.

The power of alkaline fuel cells improves if the hydrophobicity of GDE decreases. However, the penetration of liquid through the GDE was observed in low hydrophobic GDE in a long time testing alkaline fuel cell. The best properties represent the GDE with 40 wt. % PTFE in the catalytic layer at the temperature 25 °C.

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