

Water Electrolysis Using Water Absorbing Porous Electrolyte Cell

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We have reported so far water electrolysis by use of a water absorbing porous electrolyte that works under similar conditions to a polymer electrolyte electrolysis cell (PEEC) [1]. This cell consist of a surface-proton conducting metal oxide nanoparticles as proton-conducting electrolyte, a controlled-hydrophobic electrocatalytic layer, and fully hydrophobic gas diffusion layer (GDL) to generate pressurized hydrogen and oxygen gases. In this presentation, we will discuss the optimized preparation condition for membrane electrode assembly (MEA), which consist of electrolyte, electrode, and GDL layers. We also show that the hydrogen gas generation rate depend on the supplied water pressure (ΔP).

The gas evolution rate of hydrogen increased with increasing ΔP from 0 MPa to 0.10 MPa, and reaches a maximum value at 0.15 MPa. At ΔP higher than 0.15 MPa, the rates decreased to almost the same value at 0 MPa. We supposed that the generated gas was leaked to outside of the cell in lower pressure region than 0.15 MPa. On the other hand, in higher region than 0.15 MPa, the generated gas in the water phase by water electrolysis was not completely separated to gas phase.

The obtained evolution rate was compatible with the theoretical value calculated by Faraday's law. However, electrolysis voltages were high compared with conventional PEEC. Possible reason is inhomogeneous state of electrode layer and electrolyte layer with lower electrical conductivity.

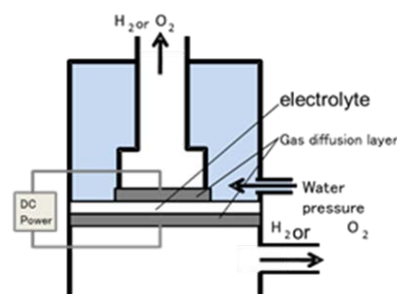


Figure 1. The Schematic Picture of Water Absorbing Electrolyte Cell.

References

- (1) S.-J. Kim, T. Sakai, H. Oda, J.-I Hamagami, Y. Okuyama, M. Matsuka, S. Ohta, Y. Shimizu, T. Ishihara, H. Matsumoto *Electrochem.* **2012** 80(4), 246.