Preparation of High Performance MEAs for Low Temperature Fuel Cells

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The Fuel cells have been receiving considerable interests as power sources for small electronics devices as well as large vehicle and residents because they exhibit high energy efficiency and are environmentally friendly. Despite these advantages, fuel cells in general need to overcome not only technical, but also economic barriers for wide applications. In order to realize the wide use of fuel cells, the performance of fuel cells has to be improved. Catalysts, support, MEA preparation, membrane, and bipolar plates are the materials involved for possible improvement. [1]

Catalysts are the core of concerns. They have to show high activity towards fuel cell reactions, especially for oxygen reduction reaction, and enough stability for extended usage. Also efficient use of catalyst can reduce the over-all cost. One of ways to enhance and improve the efficiency is to increase the number of triple-phase boundaries, where catalyst meets reactant and conductive (electronic as well as ionic) sites.

In this respect, works performed in our group for fuel cell catalysts will be summarized; they are preparation of catalysts by galvanostatic pulse electrodeposition on Nafion-bonded carbon layer (Fig.). [2,3] Catalysts prepared by the electrochemical deposition show significant improvement in performance even though the amount of metal is far less than conventional experiments. It is due to the utilization of catalysts was improved significantly because the deposition of metal occurred only on the surface.

And a highly active, stable and low-cost non-precious metal ORR catalyst was prepared by direct synthesis under autogenic-pressure conditions. [4] These are based on highly porous Fe–N–C and Co–N–C structures. Also effects of the support morphology on the electrocatalytic oxygen reduction reaction for Pt-Ni nanoparticles were demonstrated. [5]

Details of experimental procedures and results will be discussed

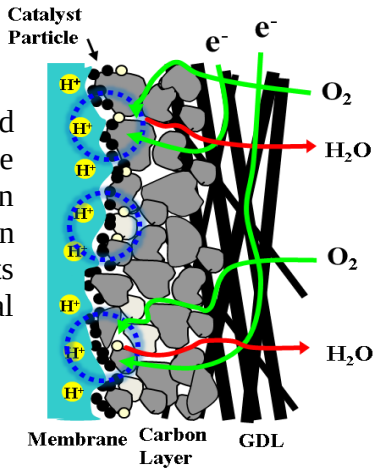

Fig. Electrochemical Deposition.

References

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