

Ultralow Active Metal decorated Mesoporous Porphyrinic Carbon for Oxygen Reduction Reaction (ORR)

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Exploring the cost effective electrocatalyst with high activity and durability is one of the most important challenges for the commercialization of polymer electrolyte fuel cells (PEFCs). Many researches focuses on the development of non-precious metal catalysts or low platinum based Pt-M alloy by morphological and structural tuning with inexpensive transition metals. Recently, we found that the self-supported ordered mesoporous porphyrinic carbon (OMPC) which has a comparable ORR kinetic activity with Pt/C under a relatively large amount of catalyst ( $>0.6 \text{ mg/cm}^2$ ) loading. Unfortunately, a thick membrane electrode with a high catalyst loading is unfavorable for the cell performance in terms of cell resistance and gas diffusion resistance. In this study, we examined an alternative catalyst combined with a trace of platinum nanoparticles and OMPC as a substitution for the carbon supports generally being used. The ultralow platinum ( $\sim 5 \text{ wt.}\%$ ) loaded Pt/OMPC showed a 10 times enhanced ORR kinetic activity compared to that of OMPC itself at 0.9 V RHE. The Pt mass activity was also improved by 7 times compared to that of Pt/C at 0.85 V RHE.