Structure-Activity Relationship in Ordered Mesoporous Porphyrinic Carbon Catalysts for Oxygen Reduction Reaction

천재영, 주상훈†
울산과학기술대학교
(shjoo@unist.ac.kr†)

We present the systematic investigation of structure-activity relationship in highly active and durable non-precious metal catalysts based on ordered mesoporous porphyrinic carbons (M-OMPC; M = Fe, Co, or, FeCo) for the oxygen reduction reaction (ORR). The M-OMPC catalysts were synthesized via a nanocasting method, using mesoporous silica as a template and metalloporphyrins as a precursor, respectively. The control of heat-treatment temperature and precursor type during the synthesis resulted in differing metal contents and metal-N environment, leading to the remarkable differences in electrocatalytic activity for the ORR. The highest ORR activity was achieved with a catalyst heat-treated at 800 oC with distinct M-N bond, which are often proposed to be active sites for the transition metal/nitrogen/carbon based catalysts in the ORR. X-ray absorption spectroscopy analysis revealed a good correlation between ORR activity and the coordination environment of M-N structures.