

Promoting Alkaline Hydrogen Evolution Activity by Ordered Mesoporous Metastable α - MoC_{1-x} with Enhanced Water Dissociation Capability

백두산, 정관영, 곽상규, 주상훈[†]
울산과학기술원
(shjoo@unist.ac.kr[†])

The sluggish kinetics of the alkaline hydrogen evolution reaction (HER) remains an important challenge for water-alkali electrolyzers. In this work, we demonstrate that metastable, face-centered-cubic α - MoC_{1-x} phase showed superior water dissociation capability and alkaline HER activity than stable, hexagonal-close-packed β - Mo_2C phase. Based on this, we prepared ordered mesoporous α - MoC_{1-x} (MMC) via a nanocasting method. In MMC structure, the α - MoC_{1-x} phase facilitates the water dissociation reaction, while the mesoporous structure enables a high dispersion of metal nanoparticles (NPs) and efficient mass transport. As a result, Pt NPs supported on MMC (Pt/MMC) catalyst showed enhanced alkaline HER activity in terms of overpotentials, Tafel slopes, mass and specific activities, and exchange current densities, compared to commercial Pt/C and Pt NPs supported on particulate α - MoC_{1-x} or β - Mo_2C . Notably, Pt/MMC showed very low Tafel slope of 30 mV dec^{-1} , suggesting the critical role of MMC in enhancing the HER kinetics. The promotional effect of MMC was further demonstrated with an Ir/MMC catalyst.