Deliberate Structural Collapse of Sn–In MOFs for Enhanced Electrochemical Carbon Dioxide Reduction

Ko, Yeseo (School: Korea Science Academy of KAIST)
Kim, Ha-Yeon (School: Korea Science Academy of KAIST)
Jeong, Siwoo (School: Korea Science Academy of KAIST)

The production of formic acid through the electrochemical reduction of carbon dioxide has garnered significant attention as both a valuable chemical production pathway and a carbon reduction strategy. While tin-based catalysts are widely studied, the use of metal-organic frameworks (MOFs) as reduction reaction catalysts is gaining significant attention due to their high surface area and structural tunability. In particular, amorphous MOFs provide abundant defect sites, and bimetallic systems offer synergistic effects that can enhance catalytic performance. In this study, Sn(BDC)MOF and the bimetallic Sn,In(BDC)MOF were synthesized, followed by post-synthesis annealing to control the degree of amorphization. Structural and electrochemical analyses demonstrated that Sn(BDC)MOF annealed at 300 °C exhibits a faradaic efficiency of 94.9% in formate formation, signifying overwhelming catalytic performance from carbon dioxide. These results highlight the effectiveness of annealing-induced amorphization and structural tuning in MOFs for efficient Carbon dioxide conversion.

Awards Won:

Aramco: Second Place Prize Environmental Engineering (ENEV)