A sulfur-tolerant Ruddlesden-Popper oxide with exsolved Ni-Fe alloy nanoparticles for reversible Solid oxide cells (SOCs) fuel electrode

최준일, 김지훈, 맹준범, 김원배†
포항공과대학교
(wbkim@postech.ac.kr†)

SOFC/SOEC are efficient energy conversion systems for H_2 fuel operation and CO_2 electrolysis. Conventionally, Ni/YSZ has shown outstanding performance as a fuel electrode. However, this metal cermet has suffered from degradation problems such as particle agglomeration, carbon deposition, etc. Especially, sulfur source such as hydrogen sulfide (H_2S) involved in fuel/reaction gas has seriously deteriorated the cermet electrode. Meanwhile, perovskite oxide, such as Ruddlesden-Popper oxide is attractive fuel electrode candidate with superior sulfur tolerance, but has low catalytic activity. In this study, we prepared sulfur tolerant Ruddlesden-Popper oxide decorated with Ni-Fe alloy nanoparticles prepared by inducing in situ exsolution. This catalyst has been applied to anode of H_2-SOFC and cathode of CO_2 electrolysis of SOEC. The exsolved alloy nanoparticles improved the catalytic activity for H_2 oxidation and CO_2 reduction. This electrode catalyst showed decent fuel operation and electrolysis performance at 850 ℃. Also, the current density only decreased within ~10% in 100 ppm H_2S containing atmosphere compared to dry H_2 and 30%CO/CO_2, indicating its superior sulfur tolerance.