

Highly active and durable iridium electrocatalyst for polymer electrolyte membrane water electrolyzer

Jahowa ISLAM^{1,2}, Sang-Kyung KIM^{1,2*} §, PHAN Thanh Thien^{1,2}, Min-Joong KIM¹,
Hyun-Seok CHO¹, Won-Chul CHO¹, Chang-Hee KIM¹, Changsoo LEE¹, Jae Hun LEE¹,
Sechan LEE¹

¹ Hydrogen Research Department, Korea Institute of Energy Research, Daejeon, S. Korea

² Major of Advanced Energy and System Engineering, University of Science and Technology,
Daejeon, S. Korea

**Presenting Author: Sang-Kyung Kim (ksk@kier.re.kr)*

§ Corresponding Author: Sang-Kyung Kim (ksk@kier.re.kr)

As part of a worldwide effort to reduce global warming by using hydrogen as an energy carrier, PEM water electrolysis technology is in the spotlight. Currently, the catalyst for oxygen evolution reaction used in PEM water electrolyzer is an unsupported iridium catalyst. To reduce the using amount of iridium, which is a precious metal, it is necessary to develop a supported catalyst. Due to the high voltage of the PEM electrolyzer anode and the acidic environment, carbon, which is electrically conductive and widely used, cannot be used as a support. In this study, a supported iridium catalyst that is more active and even superior to two commercial catalysts was developed using boron carbide as support. Boron carbide has high electrical conductivity and strong corrosion resistance. The improved activity of the iridium catalyst supported on boron carbide can be correlated to the high concentration of Ir(III) and OH species on the surface and the well-dispersed iridium nanoparticles on the support. Supported iridium catalyst on boron carbide is also found to enhance iridium stability by developing the interactions between iridium and boron carbide. These metal-support interactions inhibit the oxidative dissolution of Ir(III) and the aggregation of iridium species. To see the possibility of applying the developed catalyst to PEM water electrolysis, an MEA was made and the water electrolysis performance was confirmed. It showed the possibility of being used as a PEM water electrolysis catalyst by showing superior performance with low loading of iridium than the two commercial catalysts.