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Section of Public Relations	Dongsun Cho Section Chief 062-715-2061	Nayeong Lee Senior Administrator 062-715-2062
Contact Person for this Article	Professor Chanho Pak Institute of Integrated Technology 062-715-5324	
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Professor Chanho Pak's research team develops high-efficiency hydroelectrolysis catalyst that reduces the amount of expensive iridium by half

- GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) Institute of Integrated Technology developed a liquid catalyst synthesis method that makes highly efficient iridium oxide catalysts applicable for renewable energy-linked water electrolysis.

  - The research team greatly improved the catalytic activity and stability of the oxygen evolution reaction occurring in the electrolytic anode by controlling the oxidation state of iridium. It showed 1.1 times superior activity compared to commercial catalysts and maintained 5.3 times superior activity even after stability evaluation.

- The polymer electrolyte membrane water electrolysis system, which is easy to connect with renewable energy generation, uses an iridium-based catalyst, a precious metal, as the anode catalyst for oxygen generation reaction.

  - Water electrolysis technology obtains hydrogen by electrolyzing water, so it does not emit carbon dioxide, making it possible to produce eco-friendly green hydrogen.

- In addition, the current low water electrolysis efficiency is an obstacle for the use of green hydrogen production. To improve this, research to improve the activity and durability through the development of iridium alloys and control of the oxidization state of iridium are being actively conducted.

□ The research team developed a new liquid phase reduction method to change and optimize the oxidation state of iridium on the surface and center of the catalyst. When the iridium oxide catalyst developed by the research team was applied to a water electrolysis unit cell, it was confirmed that the performance was significantly improved compared to the existing commercial catalysts even though the amount of catalyst used was less than 50%.

- The synthesized catalyst had a gradient (slope) structure of the oxidation number of which Ir(3+) and Ir(4+) present on the surface and Ir(0) present toward the center. This structure improved both the activity and stability of the oxygen generation reaction and when the synthesized catalyst was applied to a water electrolysis unit cell. Although the amount of iridium catalyst used was less than half, it showed 5.3 times better activity than commercial catalysts after initial stability evaluation.

□ Professor Chanho Pak said, "Using the new liquid reduction method, we were able to simultaneously improve activity and durability by creating a distribution gradient of the Iridium oxide state within the Iridium oxide catalyst. As demonstrated by the unit cell, it is expected that the application to the actual system will not only increase the efficiency of the water supply in the future, but also reduce the Iridium usage in the anode."

□ This research was led by GIST Professor Chanho Pak and integrated master's and doctoral students Seung Woo Lee, Chaekyung Baik, and Chanho Pak with support from the National Research Foundation of Korea, the Korea Institute of Energy Technology Evaluation and Planning, the Ministry of Trade, Industry and Energy, and the GIST Research Institute and was published online on March 9, 2021, in the Journal of Power Sources, an internationally renowned journal in the field of energy.