Gwangju Institute of Science and Technology
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Professor Chanho Pak's research team develops high-efficiency, low-cost, non-platinum-based fuel cell catalysts

☐ GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Integrated Technology Professor Chanho Pak's research team developed a non-platinum catalyst that is superior to platinum and has superior performance under basic * conditions.

> * base: It is a substance that reacts with acid to form a salt, and when dissolved in water, produces hydroxy ions. Examples are ammonia water, lye, etc.

◦ Conventional hydrogen fuel cells mainly use platinum as a catalyst, but scarcity and high price factors act as a barrier to the application of a wide range of fuel cells. Therefore, there is an increasing demand for developing high-performance, low-cost catalysts that can replace platinum.

◦ In addition, studies have been conducted to improve activity by using other elements or functional groups such as sulfur and cobalt as catalysts, but these have disadvantages of complicated processes and high costs.

☐ The research team controlled only the catalyst particle size so that the catalyst could effectively access the electrolyte. In particular, it is expected that fuel cells can be widely applied to automobiles, power plants, and households by introducing inexpensive non-platinum catalysts instead of expensive platinum.

◦ The non-platinum-based catalyst developed in this study was prepared by the nano-casting method * which supports carbonization ** after supporting iron and nitrogen precursors *** on porous spherical silica ***. It was confirmed that it exhibited superior performance to platinum as an oxygen reduction reaction catalyst due to the bond between iron and nitrogen.

* nano-casting method: A method of manufacturing porous materials by using a solid metal oxide with pores as a mould frame, putting precursors of material to be manufactured in pores, solidifying them in various ways, and selectively removing only the mould frame to manufacture the porous material in its reverse phase.

** carbonation: A method for producing a carbon-rich material by thermally decomposing an organic substance at a high temperature

*** precursor: a compound with a specific element

**** porous spherical silica: ball-shaped silicon oxide with multiple pores

□ The research team used different sizes of silica moulds to adjust the size of carbon catalysts, including iron-nitrogen. This also explains the correlation between catalytic particle size and electrolyte * accessibility.

* electrolyte: a method that conducts electricity by dissolving in a polar solvent like water to form ions

◦ The smaller the size of the carbon particles, the larger the area of contact between the carbon particles and the electrolyte, which improves accessibility. In addition, considering the reduction in performance, the most appropriate particle size was experimentally verified in the approach used in this experiment.

□ Professor Chanho Pak said, "This study is most significant in that it has developed a non-platinum oxygen reducing catalyst that can be applied to anionic electrolyte hydrogen fuel cells. We expect that it will help reduce the unit price of hydrogen fuel cells through the development of low-cost new oxygen-reduction catalysts in the future and hope that it will contribute to a wide range of commercialization."

□ This research was led by GIST Professor Chanho Pak and conducted by master's student Jiyeon Lee and integrated student Jong Gyeong Kim with support from the National Research Foundation of Korea and was published on May 11, 2020, in the *Journal of Energy Chemistry*, an internationally renowned journal of applied chemistry.