

**Section of
Public Affairs**

Mi-Yeon Kim
Section Chief
(+82) 62-715-2020

Nayeong Lee
Senior Administrator
(+82) 62-715-2024

**Contact Person
for this Article**

Professor Bongjin Mun
Department of Physics and Photon Science
(+82) 62-715-2882

Release Date

2018.07.16

Professor Bongjin Mun's joint research team successfully performs real-time observation of chemical reaction of an alloy catalyst

- GIST (President Seung Hyeon Moon) – Professor Bongjin Mun's research team from the Department of Physics and Photon Science, in collaboration with KAIST research team, has observed chemical reaction processes on an alloy catalyst surface in real time and clarified the reaction principle directly related to the improvement of reactivity of alloy catalyst.
 - Observations of the researchers are expected to be the basis for the improvement of the reactivity that can be applied to next generation high performance catalyst design.
- Professor Bongjin Mun's research team co-authored the paper "Adsorbate-driven reactive interfacial Pt-NiO_{1-x} nanostructure formation on the Pt₃Ni(111) alloy surface" with KAIST Jeong Young Park's research team in Science Advances on July 13, 2018.
- Alloy catalysts are superior to single metal or metal oxide catalysts and are used for fuel cell reactions and carbon-based industrial chemical reactions. However, the fundamental principles of alloy

catalysis have not been elucidated, and it is difficult to explain the unexpected results of catalyst research.

- To solve the problem, the researchers used an 'atmospheric pressure scanning tunneling electron microscope' and 'atmospheric pressure X-ray photoelectron spectrometer,' which greatly improved the limitations of existing surface direct observation devices, to dramatically observe the surface of the platinum-nickel alloy catalyst.
 - This revealed that the reason for the improvement of the reactivity of the platinum-nickel alloy catalyst in the actual reaction environment starts from the surface formation of the metal-oxide interface nanostructure.
 - In addition, the relatively low activation energies of the metal-oxide interface nanostructure compared to the platinum or nickel oxide single catalysts in the carbon monoxide oxidation reaction can provide a more favorable chemical reaction pathway for the improvement of the reactivity in the catalytic reaction principle. This result is proved by quantum mechanics modeling calculations based on the density function theory.
- Professor Bongjin Moon, who led the atmospheric pressure surface analysis, said, "This research is a complete surface physics study that simultaneously measures the movement and reactivity of living and breathing atoms moving in unison with external molecules."
- KAIST Professor Jeong Young Park said, "This is the first case study to directly observe the alloy catalytic reaction process in the actual reaction environment that conventional surface science based on an ultra-high vacuum environment cannot perform."
 - KAIST Professor Yousung Jung, who led the analysis of theoretical principles, said, "Through direct observation and quantum computation, we found that the main active site of the alloy catalyst

is the interface, which is an important clue to the design and optimization of various alloy catalysts."

- This research was carried out with support from Basic Science Research Institute, the National Research Foundation of Korea, and GIST (Gwangju Institute of Science and Technology).

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