

**Section of  
Public Affairs**Mi-Yeon Kim  
Section Chief  
(+82) 62-715-2020Nayeong Lee  
Senior Administrator  
(+82) 62-715-2024**Contact Person  
for this Article**Professor Seung Hyeon Moon  
School of Earth Sciences and  
Environmental Engineering  
(+82) 62-715-2435**Release Date**

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## **Professor Seung Hyeon Moon's research team made a breakthrough improvement in the conductivity of Nafion membranes to improve the performance of fuel cells and batteries**

- GIST (President Seung Hyeon Moon) Professor Seung Hyeon Moon of the School of Earth Sciences and Environmental Engineering has succeeded in improving the electrical conductivity of Nafion membranes, which play a key role in fuel cells and batteries, to the world's highest level through structural control using electric fields.
- The market for fluorine-based membranes such as Nafion has grown 80 times in the last three years and is expected to net around 1.1 trillion won in 2022 \* . Nafion (fluorine-based) membranes are in the early stage of production in Korea, and the technology for producing high-performance membranes from expensive raw materials has a very large industrial impact on both domestic and international markets.

\* See Fluorine-based membranes for hydrogen fuel cell automobiles:  
<http://www.dvnnews.com/news/articleView.html?idxno=13163>

- Nafion consists of a backbone that supports the entire structure along with a functional group that transfers the electrical charge. The research team also tried to align the functional groups in a randomly distributed structure by applying an electrical force to the dipoles, \* which are formed with ions at the same time that the membrane is manufactured.

\* A dipole is a separation of electrical charges and consists of two equal and opposite point charges.

- The research team filed two patents for related technology and published two papers in previous studies that increased the efficiency of non-fluorine membranes. In this study, the researchers applied this technology to the most popular Nafion and confirmed the ionic conductivity, which was nearly double compared to previous results.
  - In addition, the researchers focused on identifying the theoretical basis by using various polymer analysis methods rather than just improving the efficiency by using technology.
- Professor Seung Hyeon Moon said, "This study has great significance in that it has greatly improved the efficiency of the Nafion membrane, which is the most commonly used but was clear deficiencies in efficiency. This technology is expected to be applied to energy systems, such as fuel cells and automotive batteries in the future, contributing to performance improvements."
  - This research was led by Professor Seung Hyeon Moon (corresponding author) and Seung-bo Ryu (first author) and was supported by National Research Foundation of Korea and the Ministry of Science and Technology. The results were published on October 10, 2018, in the *Journal of Materials Chemistry A*, which is the top academic journal of the Royal College of Chemistry.

