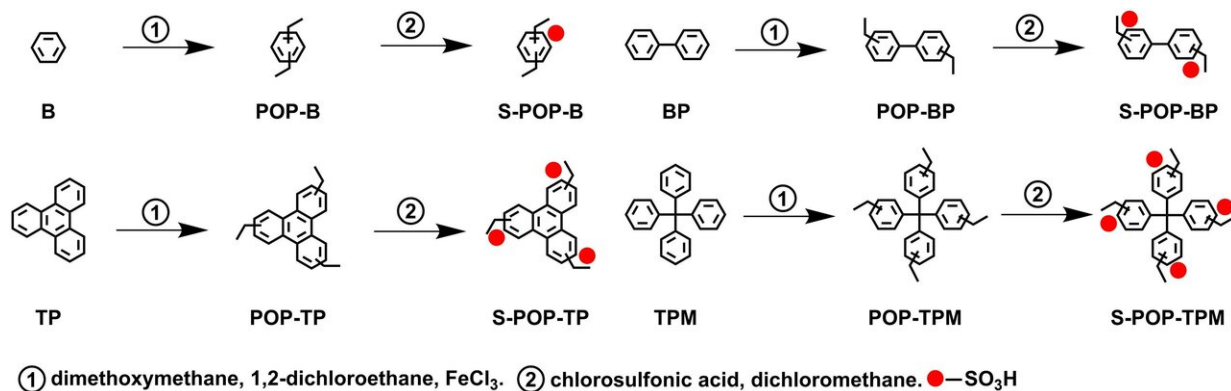


# A simple and universal design for fuel cell electrolyte

June 18 2020



Design and synthesis of POPs and sulfonated POPs (S-POPs). Credit: JAIST

Researchers at Japan Advanced Institute of Science and Technology (JAIST) and Dalian Institute of Chemical Physics, Chinese Academy of Sciences, have successfully established a universal synthetic design using porous organic polymers (POPs) for fuel cell electrolytes, according to an Editor's choice hot article published in the journal *Materials Chemistry Frontiers*.

Development of new materials for cost-effective technologies is urgent and necessary to bring about an environmentally sustainable society. Polymer electrolyte fuel cells have high expectations for a clean energy system that can support environmental protection. They must be able to

split a molecule of hydrogen into positively charged protons and negatively charged electrons. For this purpose, polymeric materials with high proton conductivity are needed. Electrons do not pass through the material, only protons pass through, so they can be extracted as electricity.

Research has shown simple, universal, and cost-effective synthetic strategy for gaining highly proton-conductive POPs as shown in Scheme 1. They show excellent proton conductivity of  $10^{-2}$  to  $10^{-1}$  S cm<sup>-1</sup>.

"In the research thus far, there were several problems—the [synthetic method](#) using POPs was complicated and the skeleton was limited. In order to establish the synthetic strategy universal for [practical applications](#), we were able to try various skeletons as POPs and established the synthetic method applicable to almost all aromatic-based materials," says materials scientist Yuki Nagao of JAIST, who has been researching proton-conducting materials for many years.

The researchers divided the synthetic steps into two steps. First, a porous organic polymer was synthesized. Second, a post-sulfonation strategy was adopted which then introduced sulfonic acid groups through the pores. The catalyst used during synthesis causes deterioration of the material during fuel cell operation, but it could also be removed by using the pores. The remarkable conductivity of S-POP-TPM was recorded on  $2.7 \times 10^{-2}$  and  $1.0 \times 10^{-1}$  S cm<sup>-1</sup> under 25 and 80 °C at 95% RH, respectively.

"Results of this study indicate that the structure of sulfonated POPs offers a simple and universal means for evolving [structural design](#) for highly [proton](#)-conductive materials," explains Zhongping Li, who is the first author of this work. The work represents a step forward towards a hydrogen society.

**More information:** Zhongping Li et al, Simple and universal synthesis of sulfonated porous organic polymers with high proton conductivity, *Materials Chemistry Frontiers* (2020). [DOI: 10.1039/D0QM00276C](https://doi.org/10.1039/D0QM00276C)

Provided by Japan Advanced Institute of Science and Technology

Citation: A simple and universal design for fuel cell electrolyte (2020, June 18) retrieved 19 April 2024 from <https://phys.org/news/2020-06-simple-universal-fuel-cell-electrolyte.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.