Hierarchically porous polymers with fast absorption

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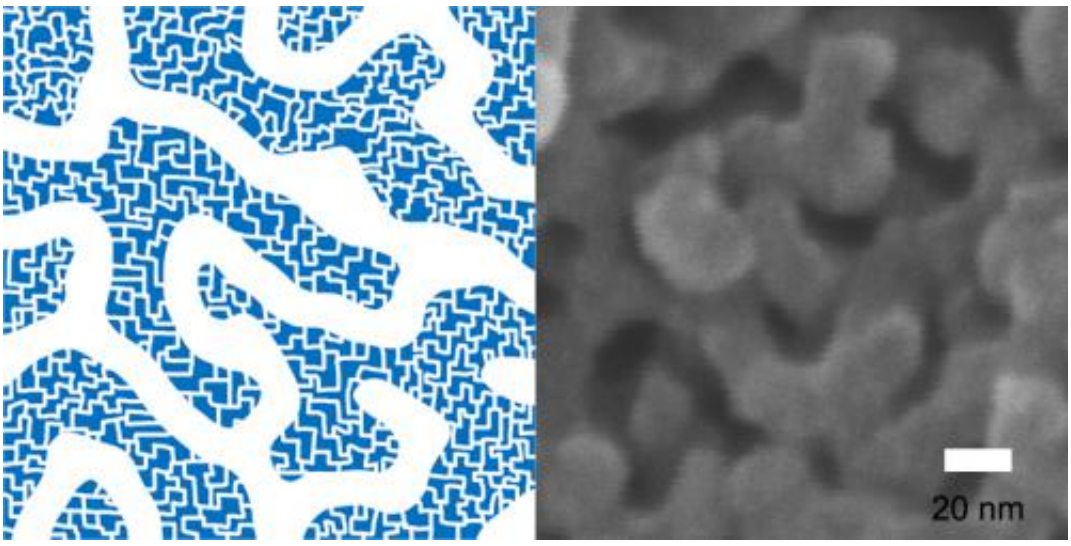

Figure 1 – Net-like Structure of Hierarchically-Porous Polymers with Mesopores and Micropores on the walls of Mesopores.

A research team at KAIST has developed a method to form micropores of less than 2 nanometers within porous polymers where 10 nanometers long mesopores connect like a net. The advantage of the porous polymers is fast absorption of molecules.

Porous polymers with micropores of less than 2 nanometers, like a zeolite, have a large surface area. They are used as a means to store hydrogen-based molecules or as a catalytic support that can be used as a surface to convert a material into a desired form. However, because the

size of the pores in its path was too small for the molecules, it took a long time to spread into the pores and reach the surface.

To reach the surface efficiently, a lung cell or the vein of a leaf has a structure wherein the pores are subdivided into different sizes so that the molecule can spread throughout the organ. A technology that can create not only micropores but also bigger pores was necessary in order to create such structure.

The research team solved the issue by implementing a "self-assembly" of block polymers to easily form a net-like nanostructure from mesopores of 10 nanometers.

The team created hierarchically-porous polymers consisting of two different types of pores by using a hypercrosslinking reaction along with the "self-assembly" method. The reaction creates micropores within the chain after the polymer chain is confined by a chemical bond.

This porous polymer has micropores that are smaller than 2 nanometers on the walls of mesopores while 10 nanometers long mesopores forming 3-dimensional net structures. Because of the "self-assembly" method, the size of mesopores can be adjusted within the range of 6 to 15 nanometers.

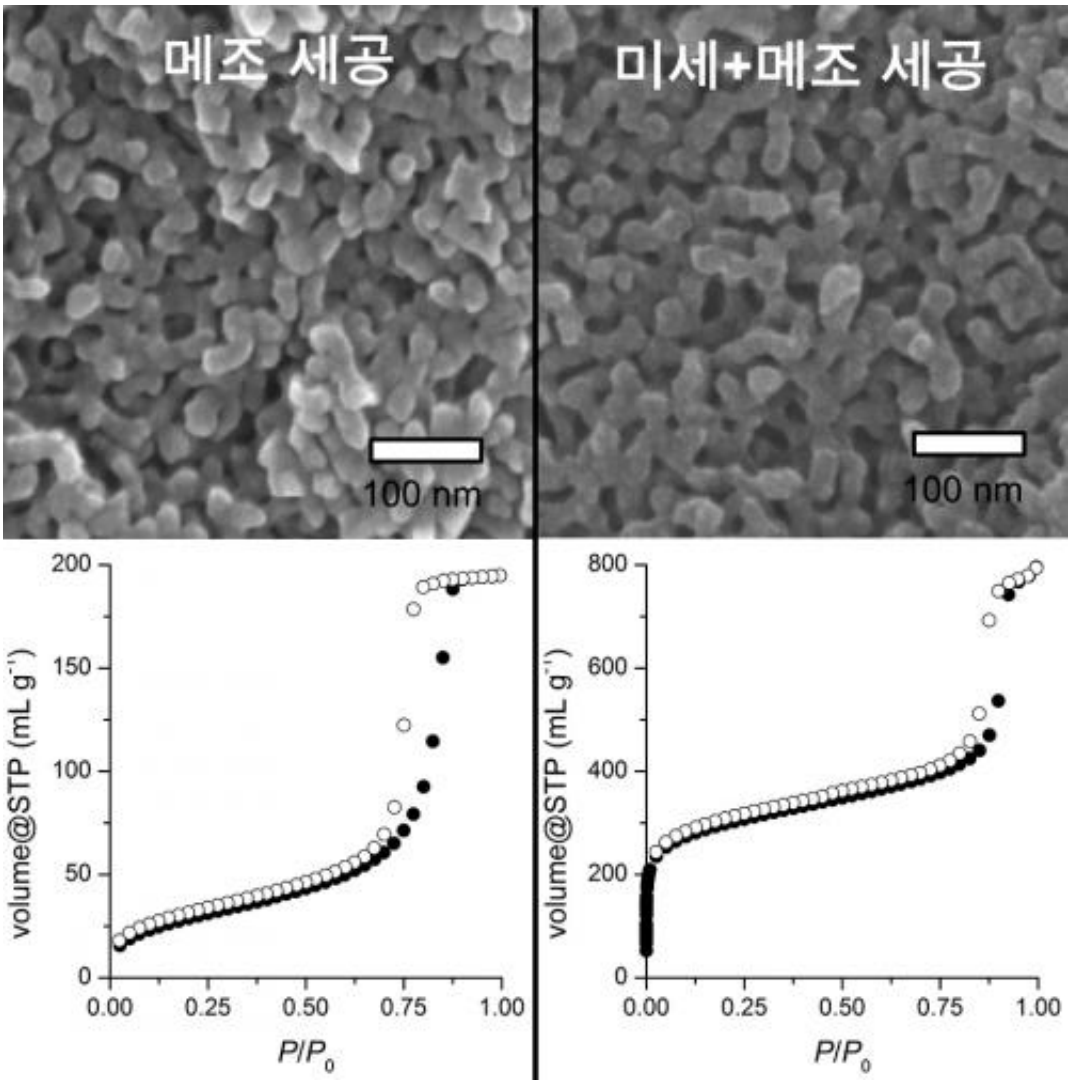

Figure 2 - Hierarchically-Porous Polymers; Figure 3 – Comparison of Porous-Polymers consisting of Mesopores only (left), and Mesopores and Micropores (right)

This is the first case where a porous polymer has both well-defined mesopores and micropores. The research team verified the effect of hierarchically-porous structures on absorption of molecules by confirming that the porous polymer had faster absorption speeds than a polymer consisting only of micropores.

Professor Seo said, "The study has found a simple way to create different sizes of pores within a polymer." He expected that the hierarchically-porous polymers can be used as a catalytic support in which fast diffusion of molecules is essential, or for molecule collection.

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