Pore and Framework Structure Engineering of Mesoporous Carbon Materials

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Recently, new series of ordered mesoporous carbon (OMC) materials have been synthesized *via* nano-replication technique using various mesoporous silica hard templates. Compared with the typical porous carbon materials such as activated carbon and carbon black, the OMCs are appropriate as catalyst supports for nano-structure materials and advanced materials due to their good electrical conductivity, high surface area, and high pore volume. To investigate the effect of physically modified porous carbon materials, we controlled physical property changes of OMCs.

First, we controlled the pore content of mesoporous carbon. We prepared bimodal porous carbon through nano-replication and nano-imprinting techniques using dual silica templates (mesoporous silica and silica nanoparticles (SNPs)). In this work, a mesoporous silica MSU-H with 2D hexagonal mesoporous structure was used as the silica template, and sucrose and 1,10-phenanthroline as carbon precursors, respectively. This carbon has two kinds of pore sizes. One is a mesopore in the range of about 4 nm and the other is around ~2 nm that is the boundary between micropore and mesopore size region.

Second, we synthesized heteroatoms (boron and nitrogen) co-doped OMCs (B,N-OMCs). Heteroatom doping is necessary to enhance specific capacitance and conductivity. Among various heteroatom dopants, boron and nitrogen show excellent electro- and chemical performance in catalysis and energy storage such as fuel cells and supercapacitors when they are doped in carbon framework of OMC. To reveal the effect of boron and nitrogen doping, we synthesized pristine OMC and boron and nitrogen doped OMC with various amounts of dopants. These co-doped materials were expected higher specific electro-catalysis than that of un-doped OMCs.

These materials are synthesized by nano-casting method and characterized by powder X-ray diffraction, N_2 adsorption-desorption isotherm analysis, X-ray photoelectron spectroscopy, and Scanning electron microscopy.

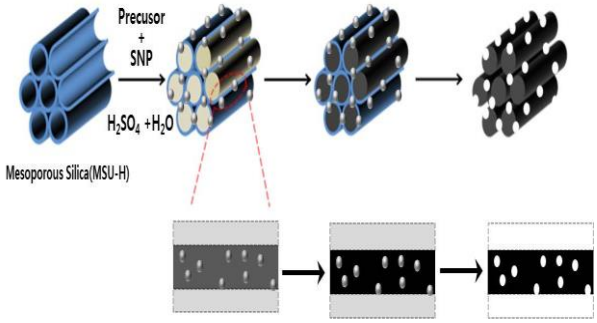

Fig. 1 Schematic diagram of the synthesis procedure for bimodal ordered mesoporous carbon.

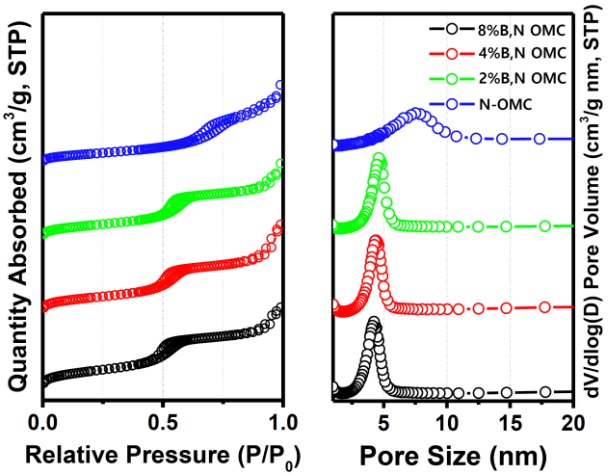

Fig. 2 N_2 adsorption-desorption isotherms and the corresponding Barrett-Joyner-Halenda pore size distribution curves of OMCs.

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