Development of Activated Carbons with Enhanced Effective Adsorption Amount

Jin Miyawaki

Institute for Materials Chemistry and Engineering, Kyushu University, Fukuoka, Japan.
International Institute for Carbon-Neutral Energy Research (I^2CNER), Kyushu University, Fukuoka, Japan.

Highly developed pore structure, and thus high specific surface area, of activated carbons (ACs) gives the superior adsorption characteristics. This talk introduces our two trials to further enhance effective adsorption amount, one of critical indexes of adsorption characteristics, of ACs.

In the first trial, we prepared ACs having different pore size and pore volume by controlling of carbonization and activation (pore development process) conditions to demonstrate how the pore structure can increase the effective adsorption amount. Ethanol adsorption measurements revealed a remarkable increase of the effective adsorption amount together with an improved adsorption kinetics for AC having suitable pore size [1]. In other words, it was confirmed that neither too narrow nor too wide pores can contribute to increase effective adsorption amount.

The second trial was done by pore-size-selective control of surface property. As most of ACs have wide pore size distribution, the modification of less-useful pores to be usable ones is effective to maximize the adsorption performance. In addition to the pore structure, surface property also influences on adsorption characteristics especially for polar molecules. Herein, we proposed a new strategy incorporating three sequential treatments – selective molecular pre-masking, surface modification, and unmasking – for pore-size-selective control of the surface properties of ACs (**Fig. 1**) [2]. To demonstrate this strategy, *n*-nonane was physically adsorbed as a molecular pre-masking agent; subsequent room-temperature ozonation was applied for surface modification to realize wide pore-selective hydrophilization. This strategy can be employed using a variety of molecular masking agents and/or surface modification methods, thereby allowing design of specific surface properties in pores within a specified size range.

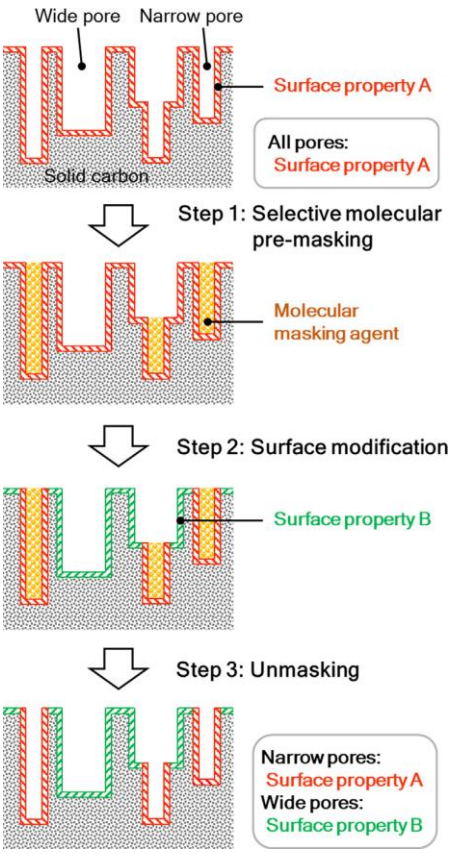

Fig. 1 A conceptual illustration of pore-size-selective control of surface properties of ACs *via* three sequential treatments [2].

References

[1] T. Miyazaki, J. Miyawaki, T. Ohba, *et al.*, *AIP Conference Proceedings*, **1788**, 020002 (2017).

[2] Y. Yu, J. Miyawaki, *Carbon*, **170**, 380–383 (2020).