Structural elucidation of physical and chemical activation mechanisms of activated carbons based on the microdomain structure model

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Activation process, which is divided into physical and chemical activations, is a key process to obtain activated carbons (ACs) with highly developed pores. The advantages of ACs prepared by chemical activation include a higher specific surface area and higher yield, compared with those produced by physical activation. However, there have been no report to explain a difference of these two activations from a structural point of view. The aim of this study is to elucidate the difference of mechanism between physical and chemical activation processes based on the microdomain structure model [1].

A phenol resin-based spherical carbon was used as a starting material. AC preparation by potassium hydroxide (KOH) activation (chemical activation) did not induce noticeable changes in the particle or microdomain sizes, despite the abundant development of pores. On the other hand, steam activation (physical activation) gave rise to remarkable decreases in both particle and microdomain sizes of ACs, depending on the activation temperature (in other words, the activation degree). Considering the differences of activation yields and degree of pore development between the chemical and physical activations, we concluded that the pore development was uniformly progressed for overall microdomains consisting of carbon particles in the case of the KOH activation, but the steam activation caused inhomogeneous gasification from the outer surface of the carbon particles and microdomains [2]. The proposed structural mechanism model for pore development by physical and chemical activations is expected to serve as a guideline for developing ACs with highly controlled pore structures.

References

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