Short-Range Ordered Structure of Activated Carbons

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Activated carbons are generally classified as amorphous, although there is long-standing evidence for a more ordered structure resembling graphite on a few nanometer length scale. Our recent results[1] have shown that water desalination occurs spontaneously in the smallest pores of PEEK-derived carbons (PDCs) activated at high temperature. It is therefore essential to describe the exact structure of such pores and their formation mechanism. A series of PDCs was characterized by PXRD and TEM, which showed graphene-like sheets organized in small graphitic domains. Raman microscopy studies revealed two types of regions with different levels of order. Gas adsorption analyses yielded a well-defined multimodal pore size distribution, and NMR allowed to deduce that all types of pores were in close proximity. These results were unified under a new supramolecular description of the structure that emphasizes the deterministic aspect of the porosity. The activation mechanism was then investigated by comparing samples activated at different temperatures. Figure 1 gives an example of activation mechanism. The results allowed to establish ways to manipulate the microstructure and properties of the material to better suit water desalination applications.

REFERENCES

[1] L. Cervini, O. D. Lynes, G. R. Akien, A. Kerridge, N. S. Barrow, J. M. Griffin; Energy Stor. Mater., 21 (2019), 335 – 346

FIGURES

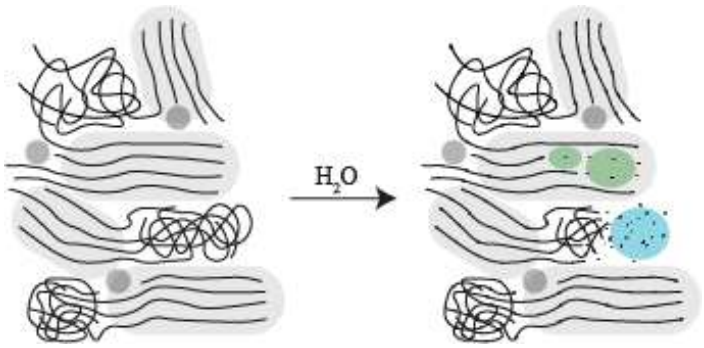

Figure 1: High-temperature steam-activation mechanism.