Nanostructured carbons obtained by template method for protein adsorption

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Nanostructured carbons were obtained by templating technique [1], using sucrose or furfuryl alcohol as carbon source and cheap commercial inorganic templates (zeolite NaY, silica gels SG60, SGAO, ZK or colloidal silica Ludox AS40) as structure directing material. After carbonisation inorganic framework was dissolved in 40% HF. Nanostructured carbons show well developed porous structure with relatively uniform pores (Figure 1). Depending on inorganic template average pore size varies from 1.0 to 11.3 nm. All nanostructured carbons have large surface area (1200–1900 m^2/g) and large pore volume (2.1–4.1 cm^3/g). Nanostructured carbons retained the shape of inorganic template used for synthesis.

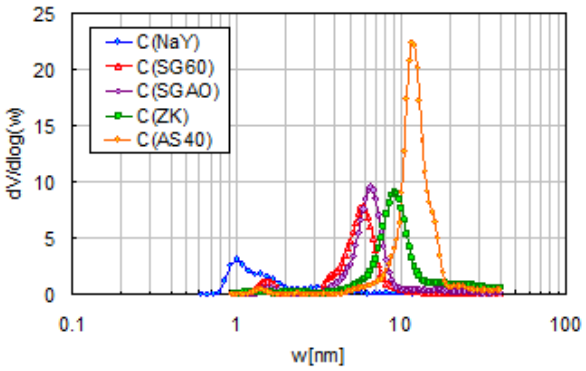

Figure 1. Pore size distributions in nanostructured carbons.

Adsorption of two proteins, ovalbumin (45 kDa) and fibrinogen (340 kDa), on nanostructured carbons was investigated. Unexpectedly, the highest adsorption was observed for carbon C(NaY) with the lowest pore size of 1 nm. The protein adsorption decreased as carbon pore size increased from 1 nm to 6.6 nm and then increased on carbons with larger average pore size. This trend holds over an order of magnitude of protein concentration in the range of 0.1–4.0 g/L. Factors related to the porous structure of carbons, such as surface area and pore volume, cannot account for the observed trend. It is likely that the conformational changes of adsorbed proteins as well as diffusion limitations of protein adsorption due to different carbon particle size contribute to the observed effect.

[1] Ryoo R, Joo SH, Kruk M, Jaroniec M. *Adv. Mater.* **13**, 677 (2001).