Porous Carbohydrate-derived Carbonaceous Materials

Shiori Kubo,1 Robin J. White,1 Markus Antonietti1, Maria-Magdalena Titirici1

1Max Planck Institute of Colloids and Interfaces, Am Muehlenberg, 14424, Golm-Potsdam, Germany

We report the production of carbonaceous materials with ordered pore structure and oxygenated surface functional groups using the hydrothermal carbonisation of carbohydrate-derivatives.[1] The method exploits the templating of block copolymer micelles within a carbon matrix in an aqueous environment. The nanostructured carbon materials were synthesised by adding fructose to an aqueous solution of EO106PO70EO106 triblock copolymer (BASF, F127®) followed by hydrothermal treatment at 130 °C. The soft template was then removed by calcination at 550 °C under an inert atmosphere. The obtained carbon materials are several-micrometers in size with cuboctahedron morphology, possessing ordered pore structures with a pore diameter of ~ 4 nm (Fig. 1a and 1b). SAXS pattern analysis shows a relatively sharp peak at q = 0.47 nm⁻¹ confirming the existence of structural regularity (Fig.1c). One important feature of the presented materials is the presence of oxygenated surface functional groups (FT-IR Fig 1d) such as carbonyl- and hydroxyl groups which allow post modification and introduction of interesting chemical moieties (e.g. functional polymers). This presented synthesis of functional porous ordered carbons via soft templating under such mild conditions is very advantageous since such materials can have important applications in fields like energy storage, drug delivery, catalysis, adsorption and many others.

Figure 1: (A) SEM, (B) TEM, (C) SAXS pattern and (D) FT-IR spectrum of the synthesized carbonaceous material.