Ordered Mesoporous Carbon/α-Alumina Nanosheets Composites

Joanna Górka, Mietek Jaroniec[*] and Wojciech L. Suchanek

Experimental

Materials. Hydrothermal synthesis of about 190 g of α-Al_2O_3 nanosheets was performed by adding the following components to 1 L titanium crucible containing 320 g of DI water: 0.93 g of 96.6% H_2SO_4, 223 g of commercial nanosized boehmite powder (having the BET surface area of 180 m^2/g, median particle size of 25 μm, and low impurities content:150 ppm Na, 55 ppm Fe, 75 ppm Si), 20 g of α-Al_2O_3 seeds (equiaxed particles up to 1 μm diameter), and the morphology modifier, which was 23.8 g of nanosized colloidal silica aqueous dispersion (40% SiO_2, AS-40, Ludox). The slurry was vigorously stirred for several minutes. The container with the precursor slurry was then placed into an autoclave (custom-made model, Autoclave Engineers, Erie, PA) and heated from room temperature to 450°C with a heating rate of 9.0°C/hr, followed by holding at the peak temperature for 10 days, with pressure about 10.3 MPa. All water from the autoclave was vented after completing the heating cycle. Other details are provided by W. L. Suchanek and J. M. Garcés in *CrystEngComm*, 2010, DOI: 10.1039/b927192a.

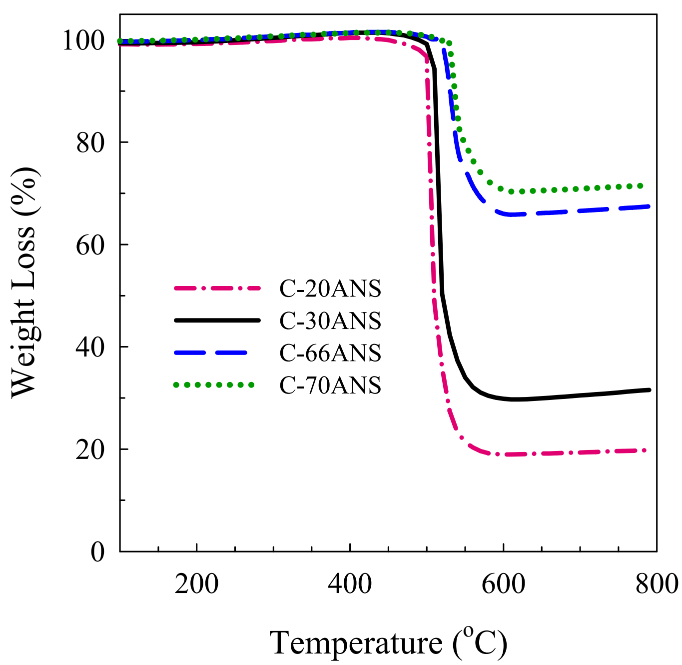

Figure S1. Thermogravimetric decomposition profiles in air for the carbon-alumina composites.

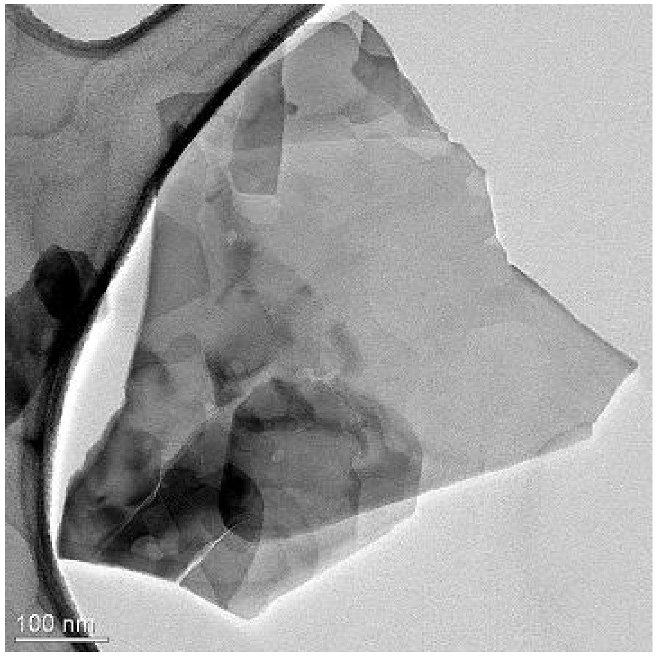

Figure S2-A. HRTEM image of α-alumina nanosheet before it was covered with carbon.

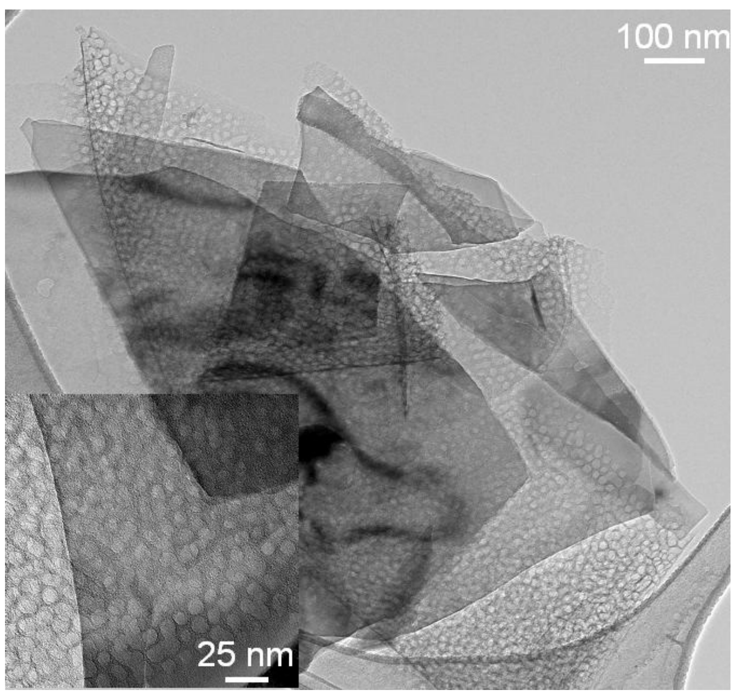

Figure S2-B. HRTEM image of mesoporous carbon on α-alumina nanosheet, C-30ANS. Several nanosheets are visible with layers of mesoporous carbon attached to them. Orientation of these mesopores is perpendicular to the nanosheets surface. The insert magnifies regular mesoporous structure of carbon on the flat surface of α-alumina nanosheets.

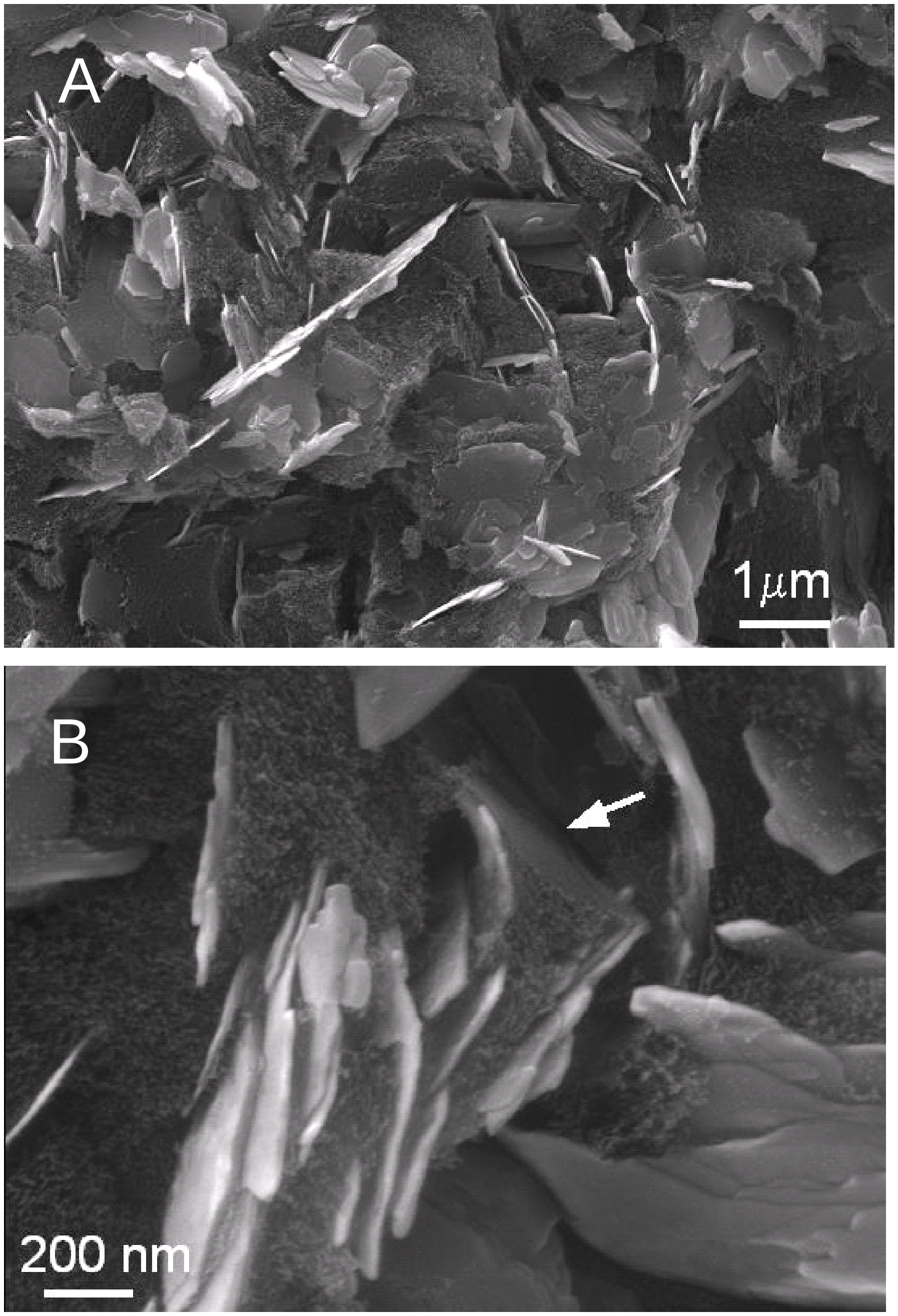

Figure S3. SEM images of mesoporous carbon/α-alumina composite, C-30ANS. **A**. Low-magnification revealing bulk microstructure of the composite. Note random orientation and various sizes of the α-alumina nanosheets; spaces between the nanosheets are filled with the mesoporous carbon. **B**. Higher magnification revealing the microstructure of the composite. Arrow shows the area from which a nanosheet was pulled out during composite fracture during sample preparation. **C-D.** Low and high magnification of the pure α-alumina nanosheets (reference) used for the synthesis of carbon-alumina composites.

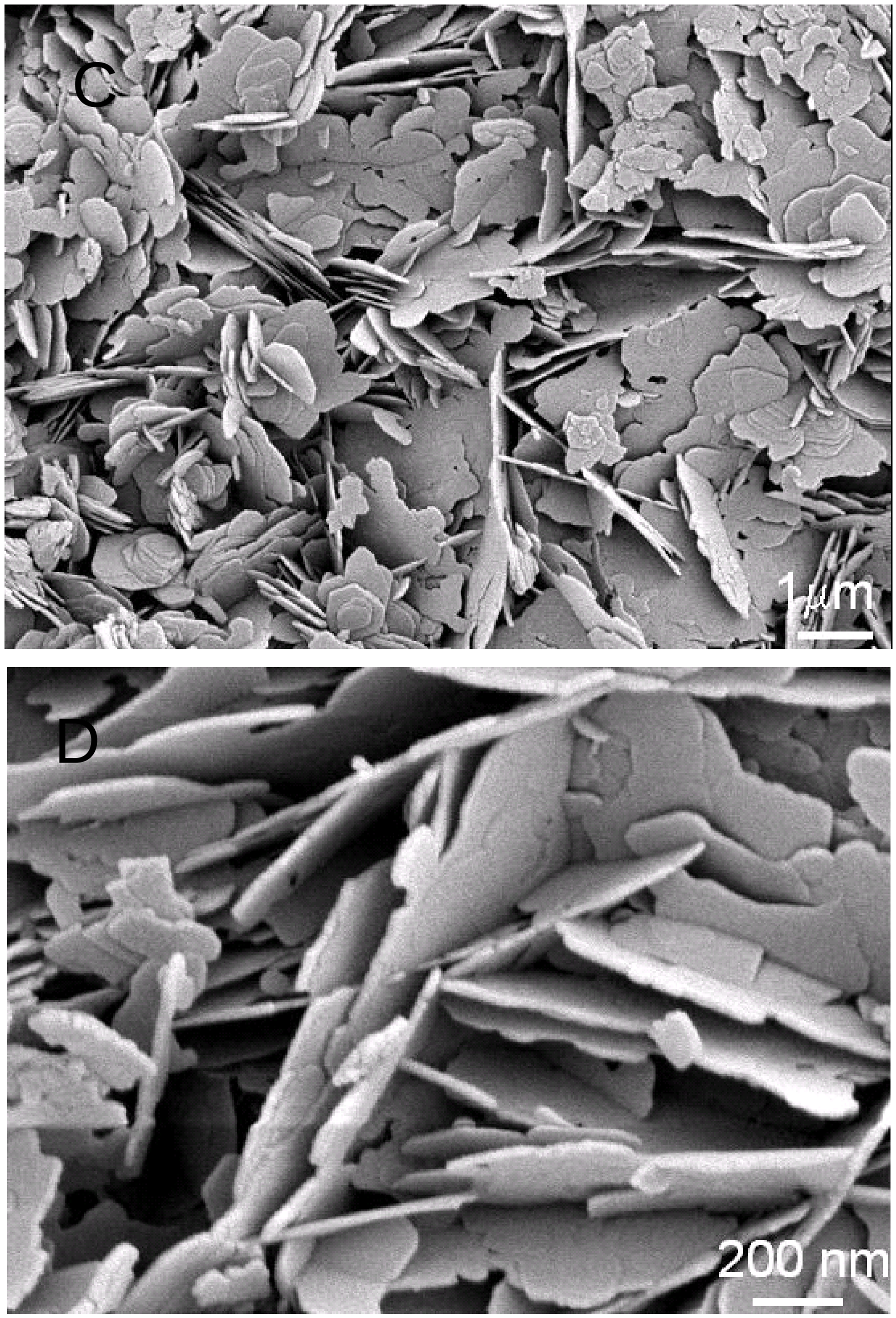

Figure S3 (continued). SEM images of mesoporous carbon/α-alumina composite, C-30ANS. **A**. Low-magnification revealing bulk microstructure of the composite. Note random orientation and various sizes of the α-alumina nanosheets; spaces between the nanosheets are filled with the mesoporous carbon. **B**. Higher magnification revealing the microstructure of the composite. Arrow shows the area from which a nanosheet was pulled out during composite fracture during sample preparation. **C-D.** Low and high magnification of the pure α-alumina nanosheets (reference) used for the synthesis of carbon-alumina composites.

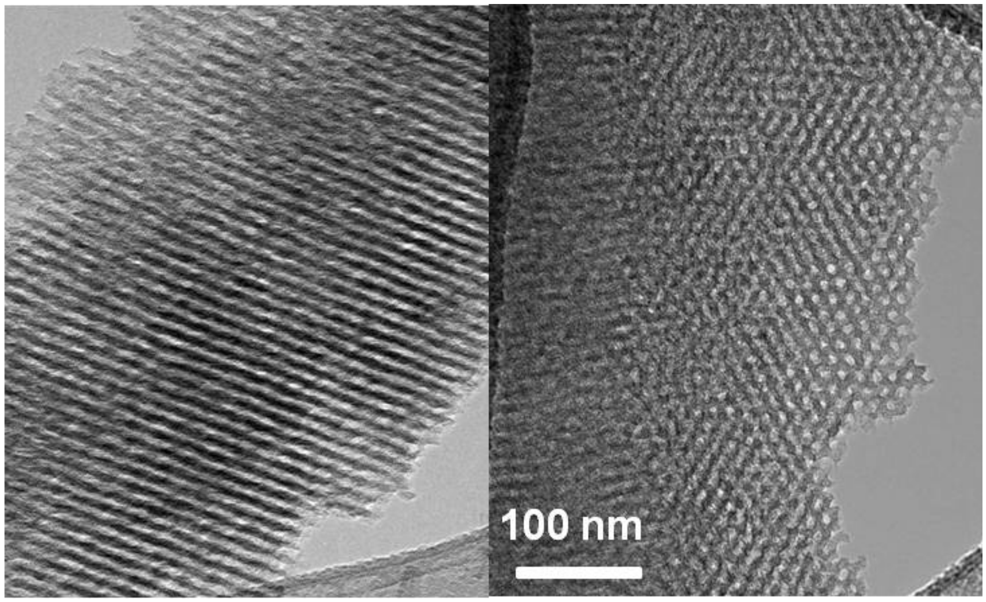

Figure S4. HRTEM images of separate mesoporous carbon particles, C-30ANS, formed in the absence of the nanosheets.