

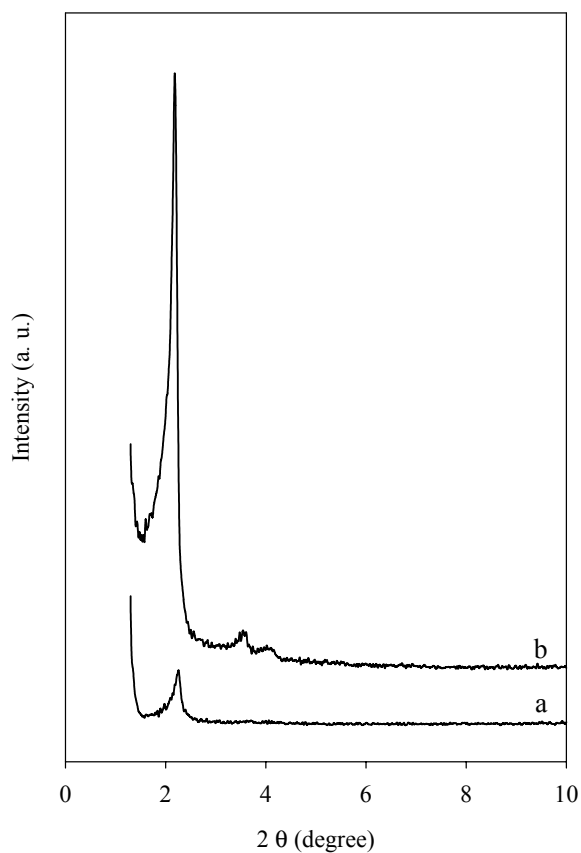
Supporting Information

Periodic mesoporous organosilica mesophases are versatile precursors for the direct preparation of mesoporous silica/carbon composites, carbon and silicon carbide materials

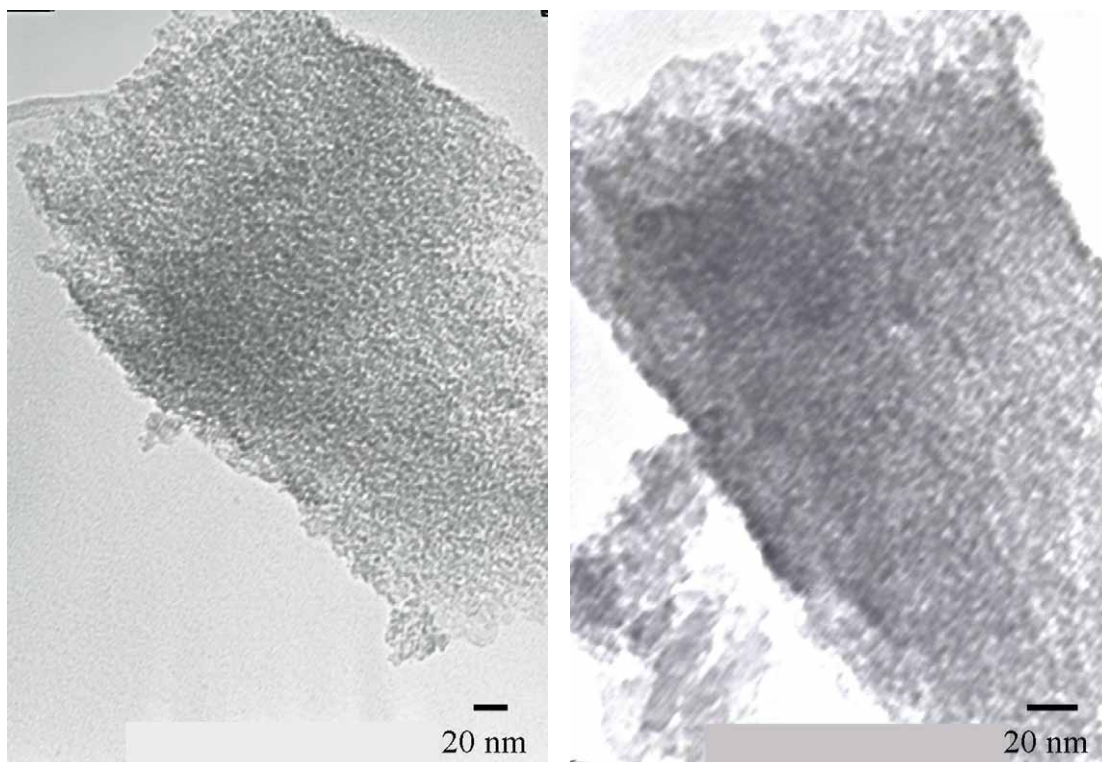
Zhuxian Yang, Yongde Xia, and Robert Mokaya*

School of Chemistry, University of Nottingham, Nottingham, NG7 2RD, UK

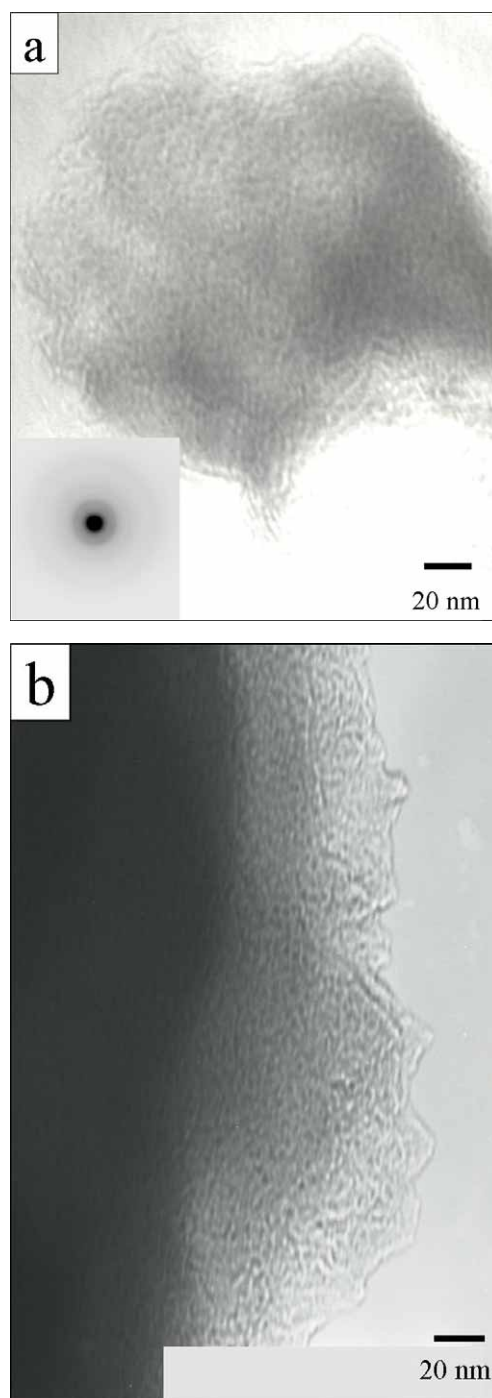
Ten additional figures showing; low angle region XRD patterns of mesoporous organosilica mesophase before and after calcination, TEM images of silica/carbon composites and nanoporous/mesoporous silica, high angle XRD patterns of silica/carbon composites, TGA curves of silica/carbon composites and silicon carbide, pore size distribution (PSD) curves of mesoporous carbon and silicon carbide and SEM images of silicon carbide.



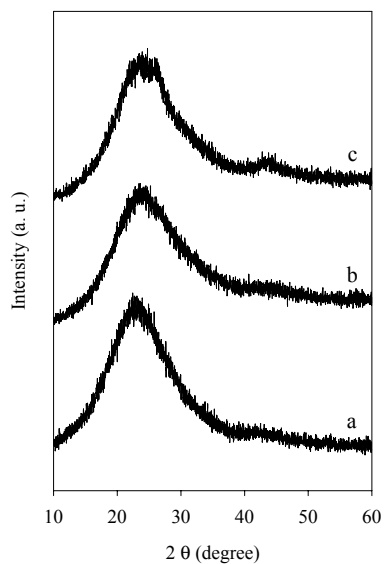
Supporting Figure S1. XRD patterns of ethyl-bridged organosilica mesophase before (a) and after (b) template (CTAB) removal by refluxing in ethanol/HCl solution to generate the mesoporous organosilica. The XRD pattern of the template free organosilica exhibits a high intensity basal (100) peak along with (110) and (200) peaks, and therefore confirms that the mesophase has hexagonal ($p6mm$) pore channel ordering.



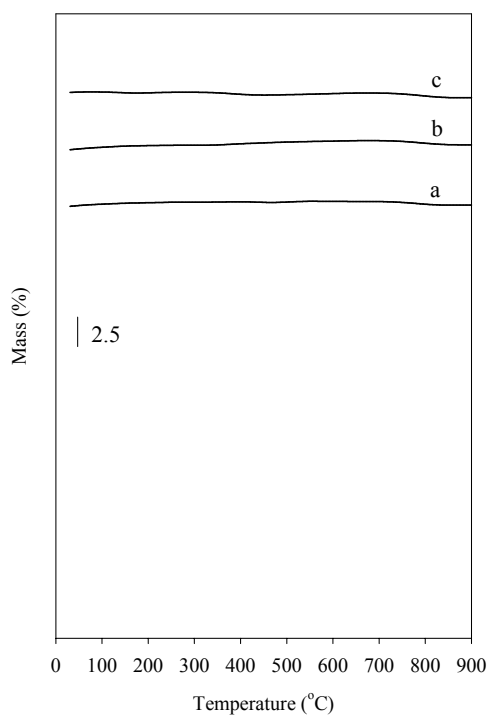
Supporting Figure S2. TEM images of silica/carbon composites prepared by pyrolysis of ethyl-bridged organosilica mesophase under argon flow at 800 °C.



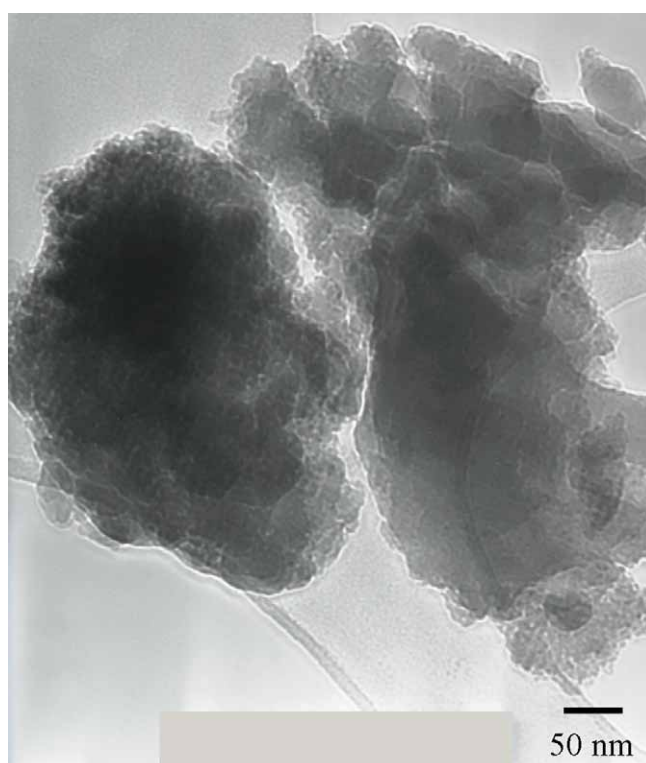
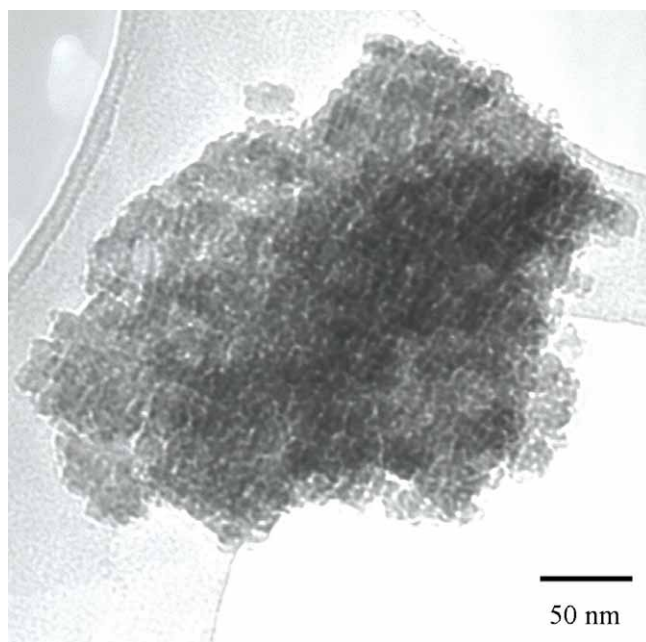
Supporting Figure S3. TEM images of (a) mesostructured silica/carbon composites prepared by pyrolysis of ethyl-bridged organosilica mesophase under argon flow at 1100 °C and (b) nanostructured silica obtained via calcination of the silica/carbon composite in air at 550 °C. The inset in (a) is selected area electron diffraction (SAED) pattern; the SAED pattern shows rings that may be ascribed to some limited graphitic ordering for the carbon component of the silica/carbon composite.



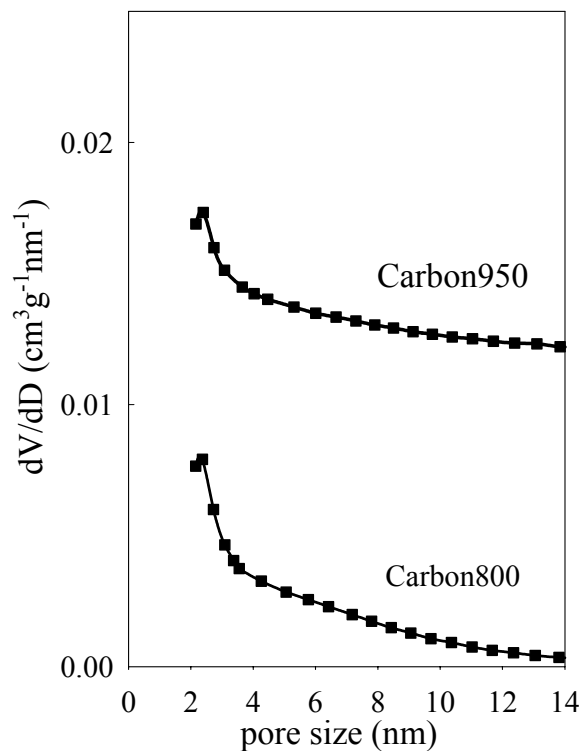
Supporting Figure S4. XRD patterns (wide angle) of silica/carbon composites prepared by pyrolysis of mesoporous ethyl-bridged organosilica at various temperatures under argon flow: (a) 800, (b) 950, (c) 1100 °C.



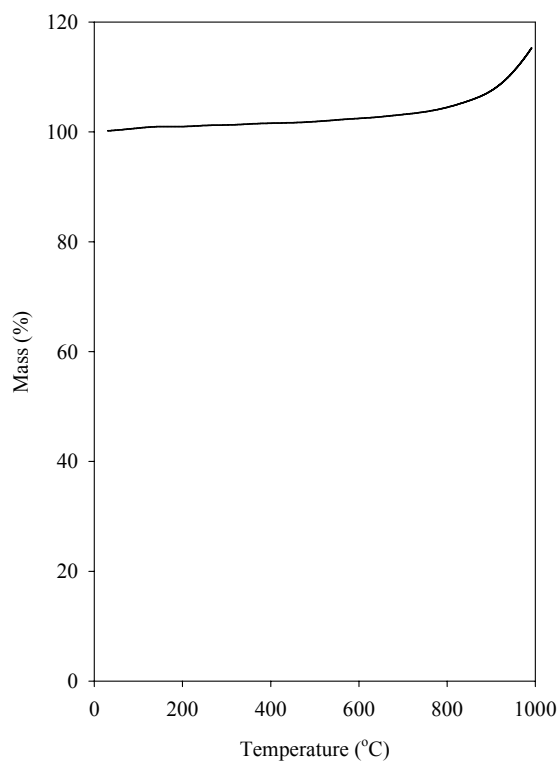
Supporting Figure S5. TGA curves of nanostructured silica obtained via calcination (in air at 550 °C) of silica/carbon composites prepared by pyrolysis of mesoporous ethyl-bridged organosilica at various temperatures under argon flow; (a) 800, (b) 950, (c) 1100 °C. The TGA curves, obtained under static air conditions, show that the nanostructured silicas are virtually carbon free; there is no significant mass loss up to 900 °C. This indicates that all the carbon is removed during calcination of the silica/carbon composites.



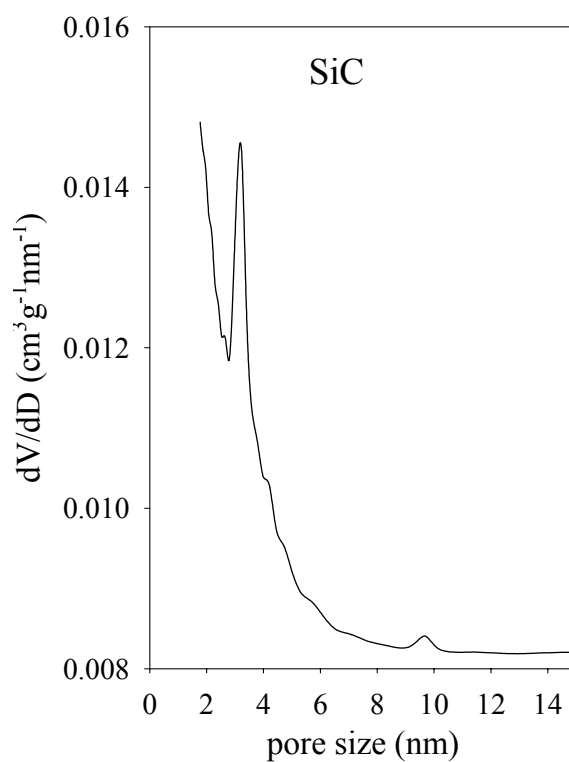
Supporting Figure S6. TEM images of nanostructured silica (Silica800) obtained via calcination in air at 550 °C of silica/carbon composite prepared by pyrolysis of ethyl-bridged organosilica mesophase under argon flow at 800 °C.



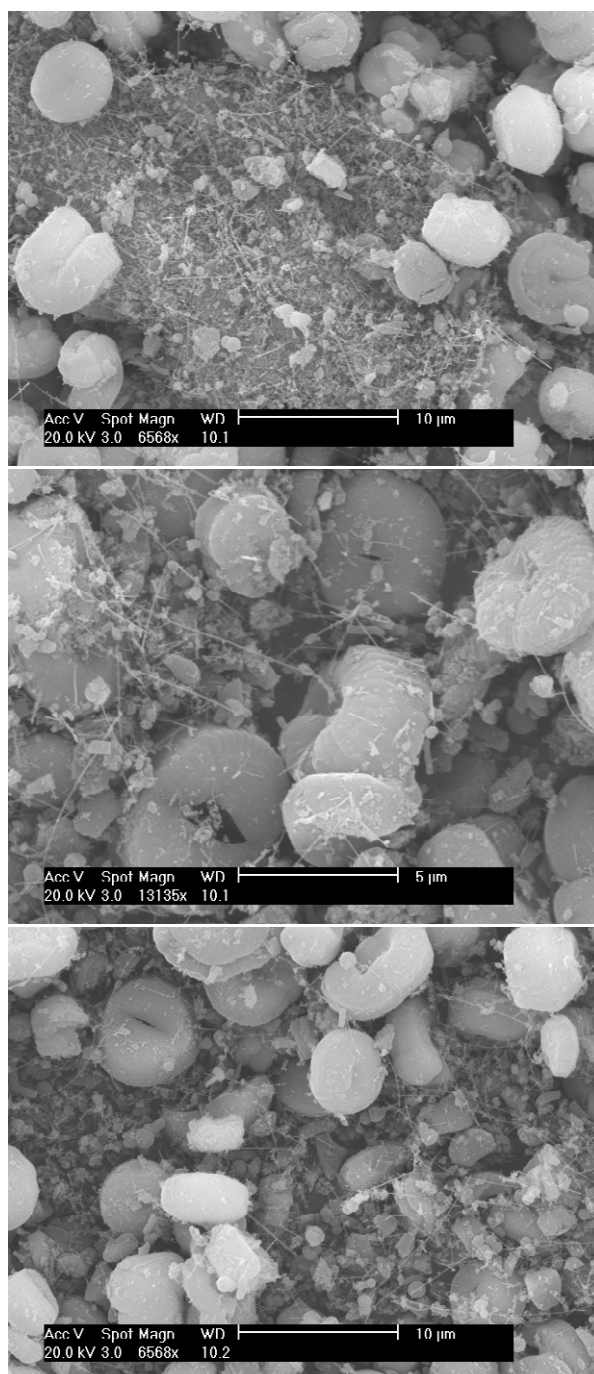
Supporting Figure S7. Pore size distribution (PSD) curves of carbon materials obtained via silica etching in hydrofluoric acid of silica/carbon composites prepared by pyrolysis of ethyl-bridged organosilica mesophases at 800 °C (Carbon800) or 950 °C (Carbon950). The PSD curves were obtained using the Howarth-Kawazoe method assuming spherical pores.



Supporting Figure S8. TGA curve of nanostructured silicon carbide obtained via calcination (in air at 700 °C/3h), HF-treatment and further calcination (in air at 700 °C/1h) of silica/carbon/SiC composite prepared by pyrolysis of mesoporous ethyl-bridged organosilica at 1300 °C under argon flow. The TGA curves, obtained under static air conditions, show that the nanostructured SiC is carbon free as there is no mass loss up to 1000 °C.



Supporting Figure S9. Pore size distribution (PSD) curve of SiC sample obtained from SiC/carbon/silica composite pyrolysed at 1350 °C after calcination (700 °C/3h in air), HF-treatment and further calcination (700 °C/1h in air) of the composite. The PSD curve was obtained via BJH analysis of nitrogen adsorption data.



Supporting Figure S10. Representative SEM images of nanostructured silicon carbide. The silicon carbide was obtained via pyrolysis of ethyl-bridged organosilica mesophase under argon flow at 1300 °C followed by calcination (700 °C/3h in air) and HF treatment to remove excess carbon and silica respectively.