

Nanoscale Morphology in Mesoporous Nanoparticles

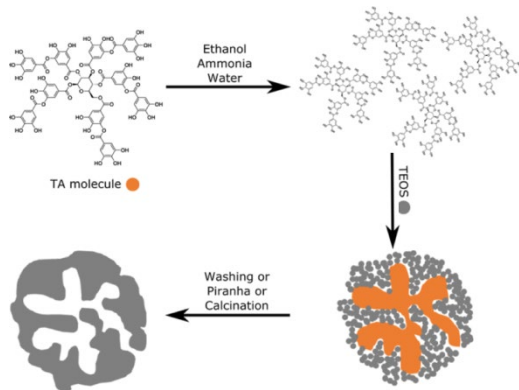


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Materials Science and Technology

Motivation and Instrumentation

The functionality of mesoporous silica nanoparticles is subject to tunable pore sizes and possible surface modification. Here, we demonstrate that particles pore size and surface morphology can evolve from non-porous particles to hollow porous particles by using varying concentrations of polyphenols as templating agents.

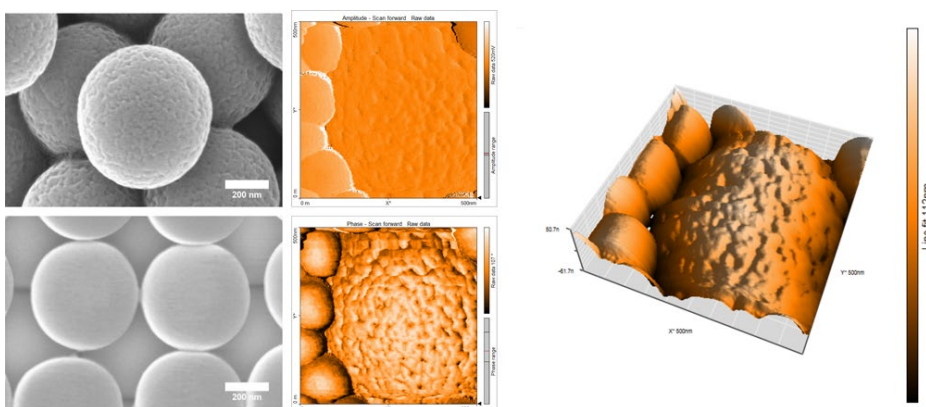


By the use of small angle X-ray scattering we systematically studied the influence of polyphenols concentration on the size, porosity and surface morphology of mesoporous silica nanoparticles.



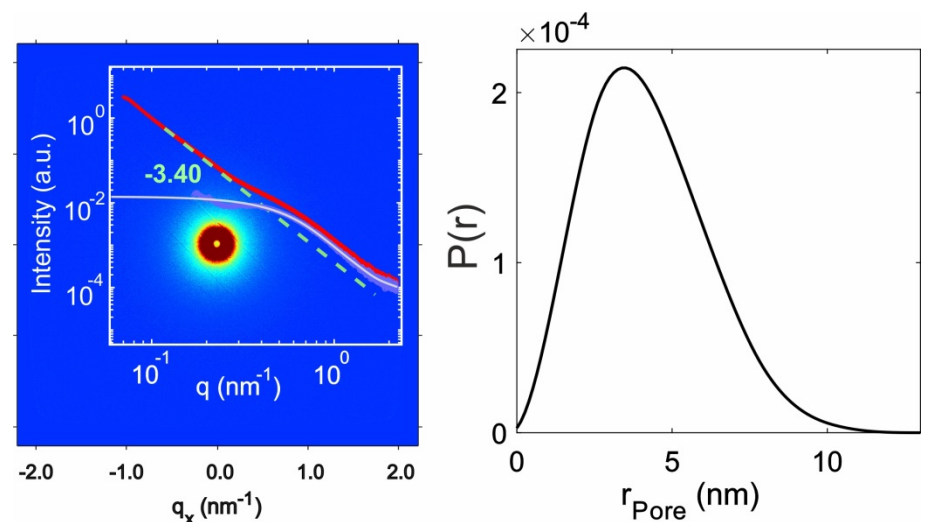
Nanostar SAXS Instruments

Electron Microscopy



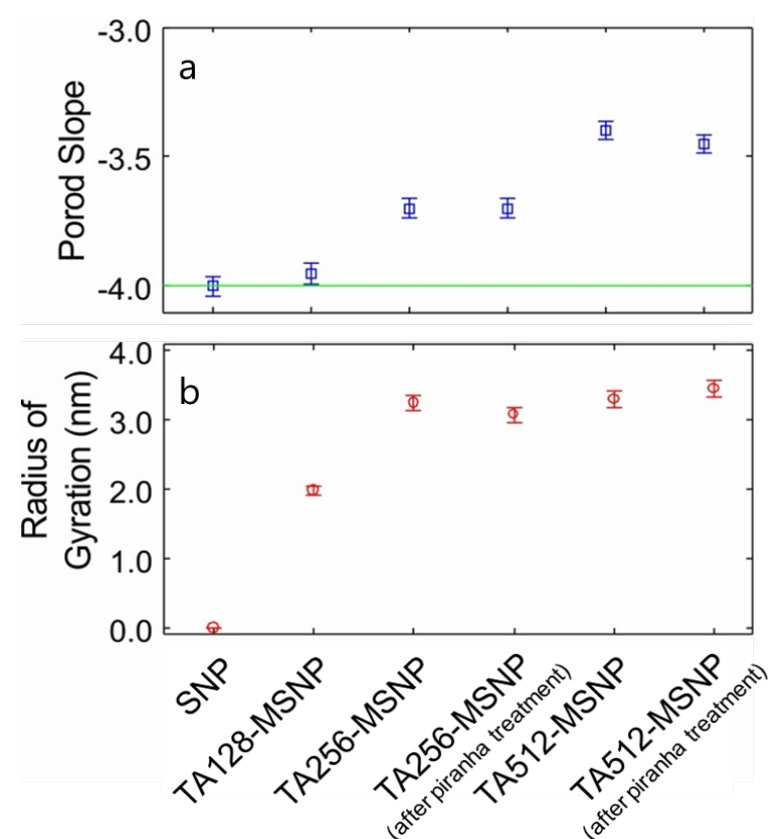
Comparison of particle surfaces. Left: SEM images of particles templated by GA (top) and EG (bottom). Scale bars 200 nm. Center: AFM images of one GA512-MSNPs particle (rough) surrounded by smooth, non-templated SNPs: amplitude scan (top), and phase scan (bottom). Scan size: 500 × 500 nm². Right: AFM 3D representation of the same particles.

Porosity Analysis of SAXS Data



The experimental scattering patterns and their relevant residual scattering obtained from subtraction of Porod line shown together with the inverse Fourier analysis (left). The pair-distance distribution function, $P(r)$ of the internal pores within silica nanoparticles (right).

Porosity data obtained from SAXS



Radius of gyration (R_g) of the pores and the Porod slope values (demonstrating increasing surface roughness) obtained from increasing concentrations of tannic acid-templated silica nanoparticles before and after piranha treatment.

Reference

J. Luo, G. Panzarasa, A. Osypova, F. Sorin, F. Spano, R. M. Rossi, A. Sadeghpour, L. F. Boesel, Chem. Mater. 2019, 31, 3192.