Precision patterning with luminescent nanocrystal functionalized beads

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Scanning electron microscope. SEM morphological analyses were performed by using a high resolution LEO Gemini field emission SEM column integrated in a ZEISS 1540 ESB Focused Ion Beam system. The working conditions were suitably tuned in order to obtain a good compromise between contrast and detail visibility; this was achieved by selecting a low accelerating voltage (2 kV), to increase the topographical contrast, and a high current mode, to improve the signal to noise ratio, in particular the signal coming from the nanoparticles.

Substrates for SEM analysis were prepared by dipping freshly cleaned silicon into either the bare or the functionalized bead colloidal suspension and let the solvent evaporate by heating at 60°C. This results in particle self assembled multi and monolayer onto silicon surface.

SEM-FEG images of assembled bare polystyrene beads (Fig.1A, 1a) and NC-functionalized PS beads (Fig. 1B, 1b) with three polyelectrolyte inter-layers (PAH/PSS/PAH) were reported in Figure 1. The images in Figure 1A and 1B underline the change in PS bead surface morphology once polyelectrolyte layers and NCs are adsorbed at the bead surface (Fig.1B) with respect to the bare beads (Fig.1A).

In particular, in Fig. 1B some large protrusion at the surface of some beads are clearly visible and could be attributed to an inhomogeneous PE wrapping of the bead surface. These polymer based hanging structures usually occur, for weak polyelectrolytes, under certain condition such as high ionic strength and pH values.[1,2,3] As a consequence the polymer charge density will affect the PE stiffness, promoting rather globular conformation than stretched one.

The images taken at high magnification (Figure 1a and Figure 1b) focus on a single bead, highlighting a smooth surface (Fig.1a) for the bare beads and a quite irregular surface (Fig.1b) for functionalized PS beads. In this last micrograph the small white spots visible onto the beads can be reasonably ascribed to NC aggregates located at the functionalized surface of the bead.

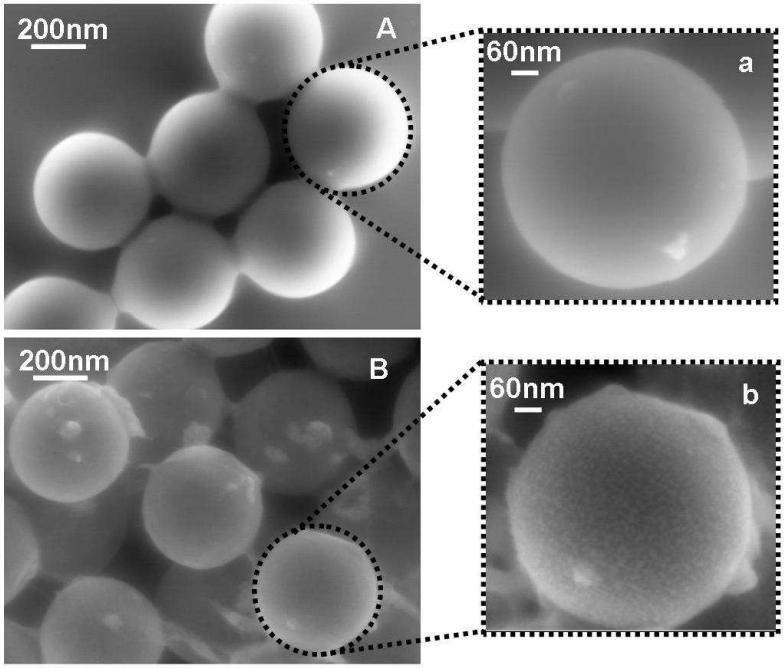

Figure 1. SEM-FEG images of bare (A, a) and NC decorated and polyelectrolytes coated (B. b) PS beads at low magnification (A; B) and high resolution (a, b) conditions.

References

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