Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A
This journal is © The Royal Society of Chemistry 2013

Electronic Supplementary Information

Magnetic polystyrene nanocomposites for the separation of oil and water

*Paolo Tempesti, Massimo Bonini, Francesca Ridi, and Piero Baglioni**

This journal is © The Royal Society of Chemistry 2013

Materials. The iron precursors (FeCl3·6H2O and FeCl2·4H2O), oleic acid, acetone and ammonium hydroxide were purchased from Aldrich. Hydrochloric acid 1N solution was purchased from Fluka. The monomer styrene was purchased from Sigma. The initiator, 2-2'-Azoisobutyronitrile (AIBN) and sodium styrenesulfonate were purchased from Polysciences, Inc.

Preparation of Magnetic Nanoparticles. Magnetic nanoparticles (MagNPs) were prepared by chemical coprecipitation. The whole procedure was performed under stirring and in nitrogen atmosphere. Iron(III) ($FeCl_3 \cdot 6(H_2O)$, 5.41 g) and Iron(II) salts ($FeCl_2 \cdot 4(H_2O)$, 1,98 g), were first dissolved in MilliQ water (130 mL, Resistivity: 18.2 mΩ·cm) and a solution of Oleic acid (2 g) in acetone (13 mL) was then added. After 30 minutes, an aqueous solution of Ammonium Hydroxide (15 mL, 25% in water) was added dropwise, taking to the formation of a black dispersion of Fe_3O_4 nanoparticles. The dispersion was heated at 85 ºC during 1 hour and then cooled to 70 ºC. A 1N HCl solution was added drop wise to reach pH=2 and protonate all the oleate groups. So obtained hydrophobic MagNPs were magnetically separated and washed several times with water, until pH=7 was reached. MagNPs were finally dried for two days at room temperature.

Small angle scattering of X-rays of magnetic nanoparticles.

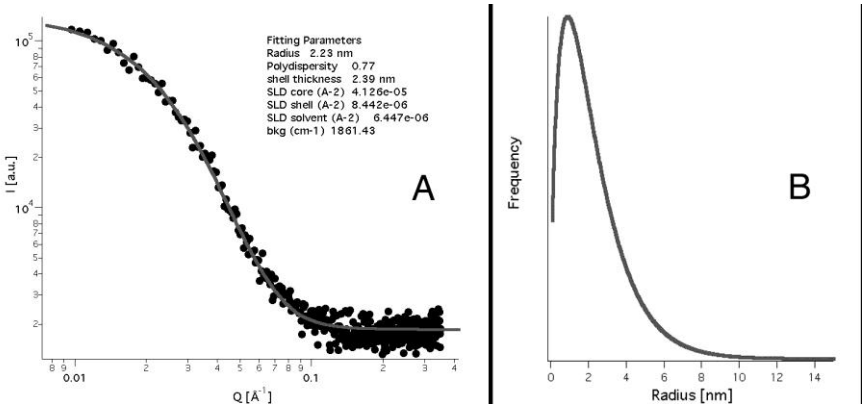

Figure SI-1. SAXS curve (black circles) together with the fit result (grey solid line) (A) and the radii distribution (B) of the magnetic nanoparticles sample. Figure B shows a mean radius of about 2 nm.

Visual aspect of magnetic beads samples.

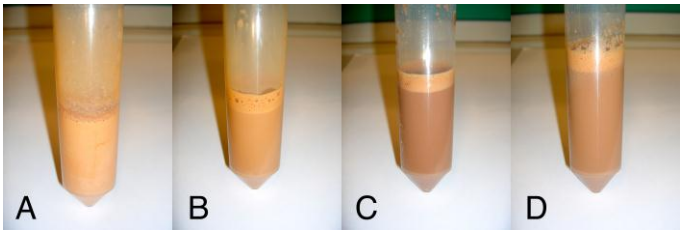

Figure SI-2. PT1 (A), PT2 (B), PT3 (C) and PT4 (D) samples. The concentration in sodium styrenesulfonate are 5%, 10%, 15% and 20% respectively.

This journal is © The Royal Society of Chemistry 2013

EDS characterization of magnetic beads samples.

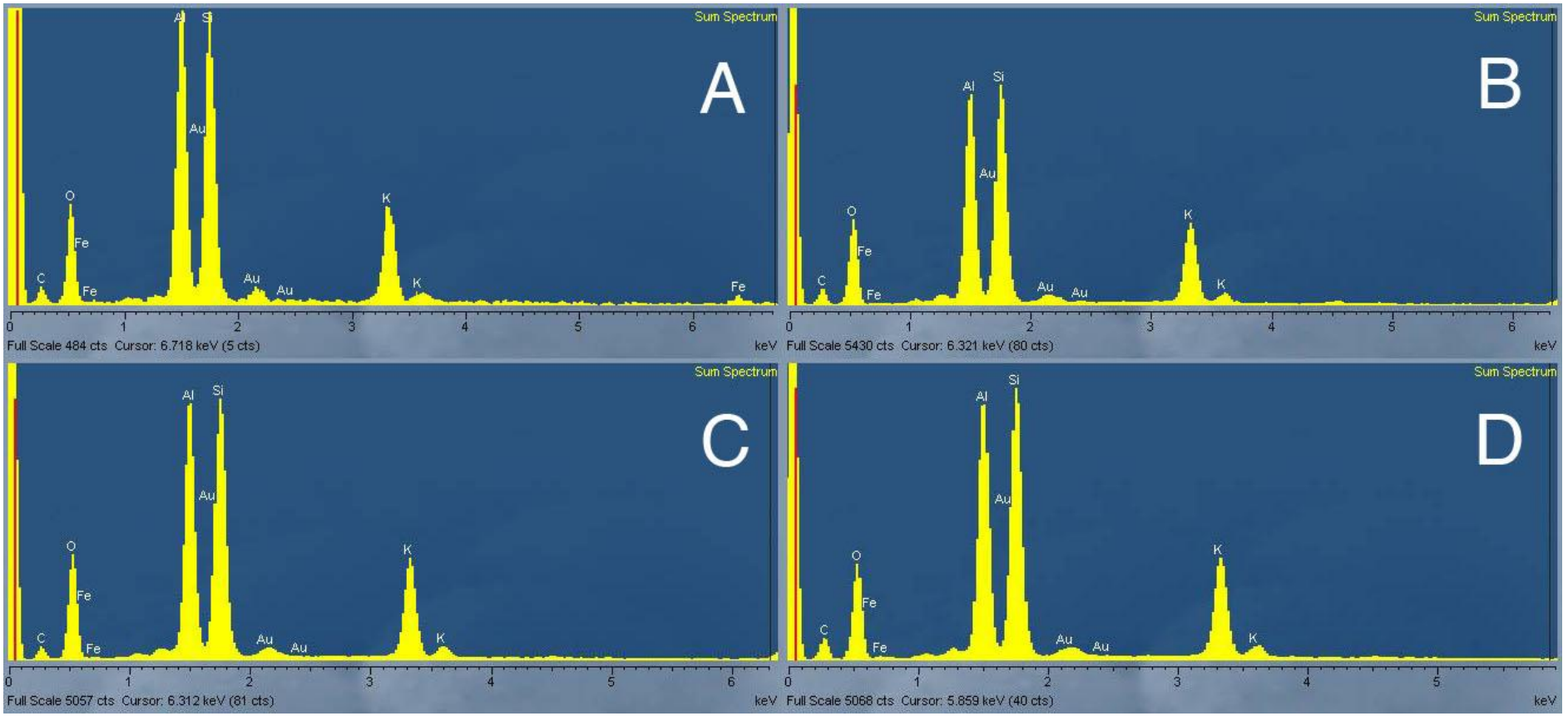

Figure SI-3. EDS spectra of PT1 (A), PT2 (B), PT3 (C) and PT4 (D) samples. Carbon, iron and oxygen are detected, confirming the composition of the latexes. The other elements come from the underlay materials.

This journal is © The Royal Society of Chemistry 2013

Table SI-1. Normalised composition of elements for the four latexes as obtained from EDX analysis.

Sample	C [%]	O [%]	Fe [%]
PT1	29.98	69.45	0.57
PT2	31.12	68.31	0.57
PT3	25.74	73.51	0.75
PT4	33.63	65.72	0.65

AFM of magnetic beads films.

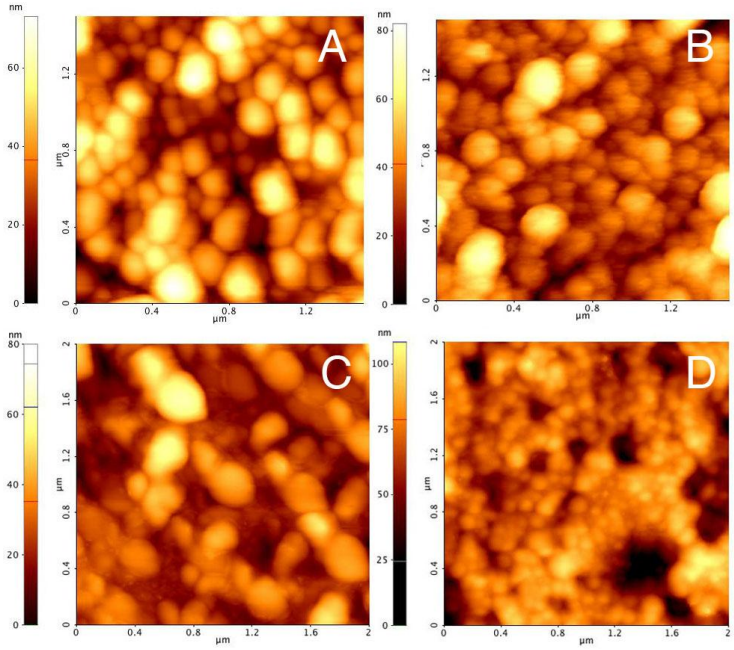

Figure SI-4. AFM images of PT1 (A), PT2 (B), PT3 (C) and PT4 (D) samples. Both micro- and nanoparticles exhibit a spherical shape and the ability to form close-packaged films.

This journal is © The Royal Society of Chemistry 2013

TGA thermograms.

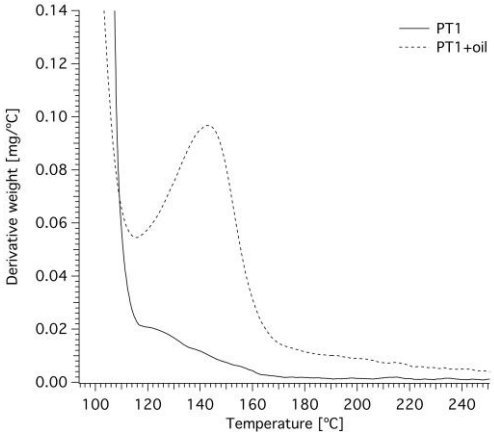

Figure SI-5. Detail of the thermograms obtained on nanobeads recovered by magnetic separation from a PT1 sample in water (solid curve) and after the upload of Diesel oil (dashed curves).

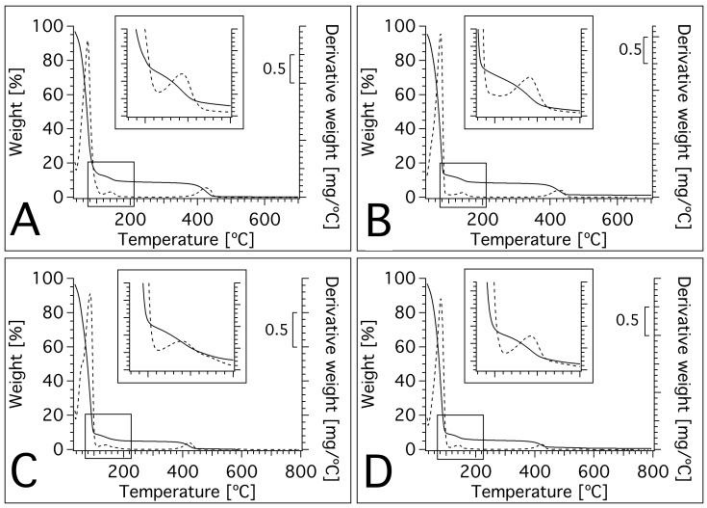

Figure SI-6. Thermogravimetry (solid curves) and differential thermogravimetry (dashed curves) of PT1 (A), PT2 (B), PT3 (C) and PT4 (D) samples after the upload of oil. The detail in each figure shows the DTG peak due to the presence of Diesel oil.

Addition of Diesel oil to PT1. A short movie showing the application of the magnetic film and migration to the air/water interface after removing the magnet is available.