A novel approach to magneto-responsive polymeric gels assisted by iron nanoparticles as nano cross-linkers

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Supplementary Information

Preparation of iron nanoparticles (Fe_{np})

14.3 g (53 mmol) $FeCl_3 \cdot 6H_2O$ was dissolved in 90 ml water then the solution of 10 g (26.4 mmol) $NaBH_4$ in 170 ml of water was added dropwise at 5 °C under argon atmosphere. The suspension must be vigorously stirred during the procedure. After the complete addition of the reducing agent, 3 more hours was allowed for completing the reaction. Then the suspension was stirred under oxygen atmosphere for 15 minutes, filtered, repeatedly washed with water and ethanol. The dried nanoparticles were stored under argon atmosphere before further use.

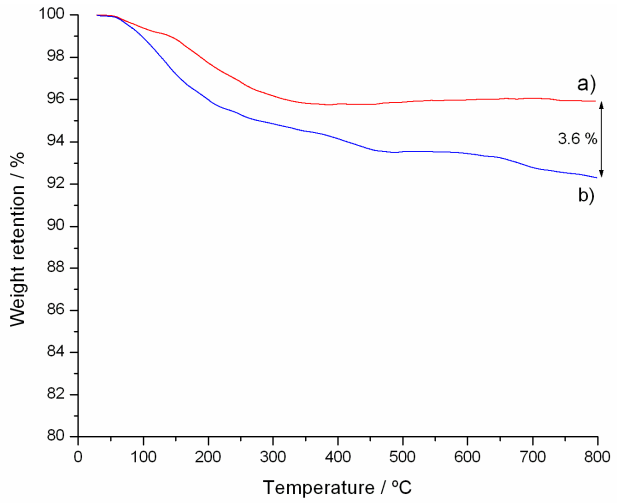

Fig. S1 Thermogravimetric analysis of a) bare Fe_{np}, b) Fe_{np}-**1**.

The weight difference (3.6 %) could be translated into grafting density an average of 2.91 nm^2 per initiator.

X-ray diffraction measurements

To determine the exact chemical composition of the magnetic nanoparicles X-ray diffraction (XRD) measurements were performed using both bare Fe_{np} and Fe_{np}-PS. XRD pattern of bare Fe_{np} showed an intensive (110) peak at 44.6° (Figure S2a). Lack of peaks at 34.5, 30.24 and 36.1° attributed to Fe_3O_4, Fe_2O_3 and FeOOH contamination respectively, confirmed that the fraction of these Fe-oxide (hydroxide) species is below the detection limit of XRD method. The shoulder at 42.5° in XRD pattern of Fe_{np}-PS (Figure S2b) could be attributed to (200) diffraction of FeO in terms of 2θ value however it is well known that FeO nanoparticles are very sensitive towards oxidation consequently their existence without the presence of Fe_3O_4 is quite unlikely [1]. X-ray diffraction of Fe_{np}-PS accumulated at lower scan speed (2 °/min) did not show the shoulder at 42.5° confirming that Fe_{np} did not undergo remarkable oxidation during the synthetic and working up processes (Figure S2c). XRD measurements were run on Rigaku RAD-IB diffractometer (operated at 35 kV and 15 mA) using Cu K_α radiation.

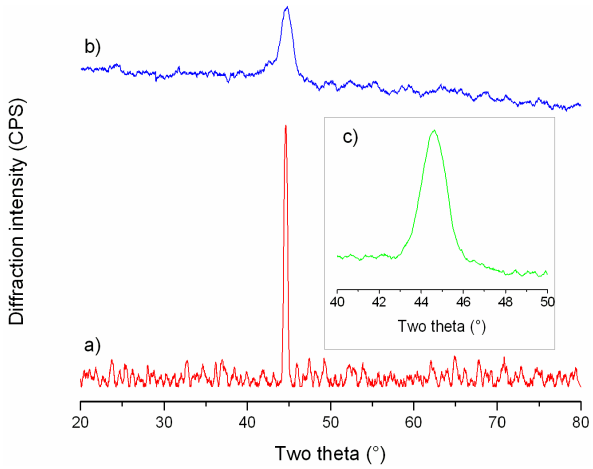

Fig. S2 Figure 8. XRD patterns of a) Fe_{np}, b) Fe_{np}-PSt (scan speed: 8 °/min), c) Fe_{np}-PSt (scan speed: 2 °/min).

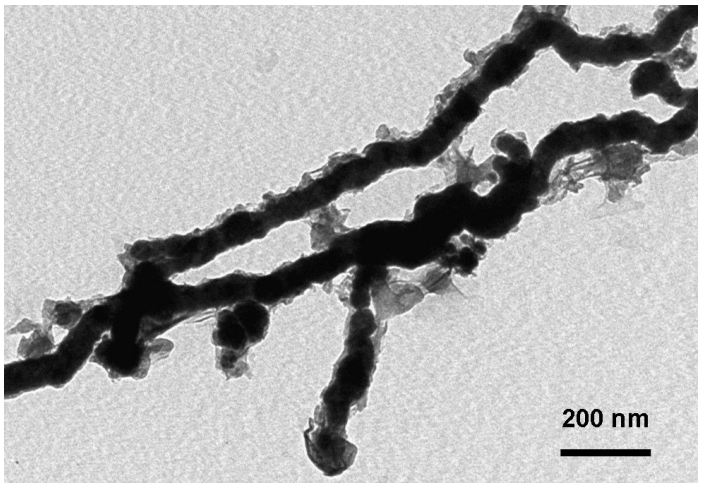

Fig. S3 TEM image of bare Fe_{np}.

Reference

[1] Y. Hou, Z. Xu, S. Sun, *Angew. Chem. Int. Ed*., 2007, **46**, 6329.