

Supplementary Information

Preparation of Nearly Monodispersed $\text{Fe}_3\text{O}_4/\text{SiO}_2$ composite particles from aggregates of Fe_3O_4 nanoparticles

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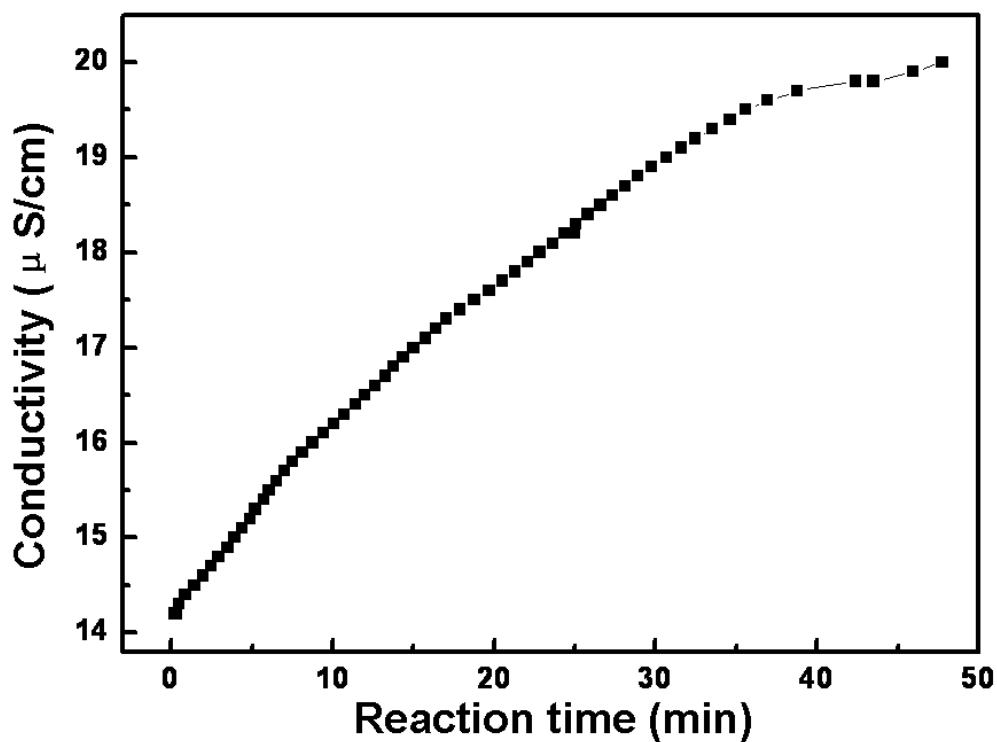


Figure S1. Conductivity measurements of Stöber system as a function of time. The conductivity of Stöber system increased from 14 to 17.5 $\mu\text{S/cm}$ in 20 min, indicating the rapid hydrolysis of TEOS and accumulation of negative charged silica species during this period.

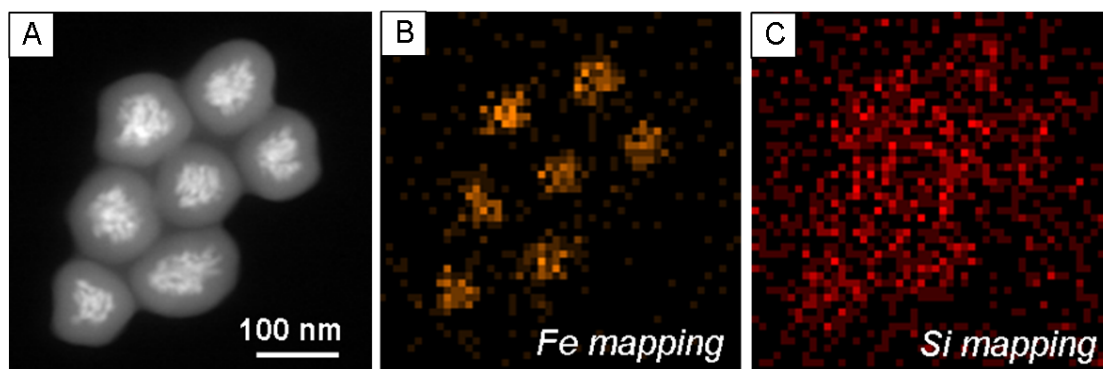


Figure S2. HAADF-STEM image (A) and HAADF-STEM -EDS mapping images (B-C) of the $\text{Fe}_3\text{O}_4/\text{SiO}_2$ nanoparticles obtained after addition of the Tween-80 modified aggregates (80 nm) into the pre-hydrolyzed Stöber system for 40 min. It is identified that the Fe_3O_4 nanoparticles were primarily located in the core part and silica in the shell part of the composite particles.

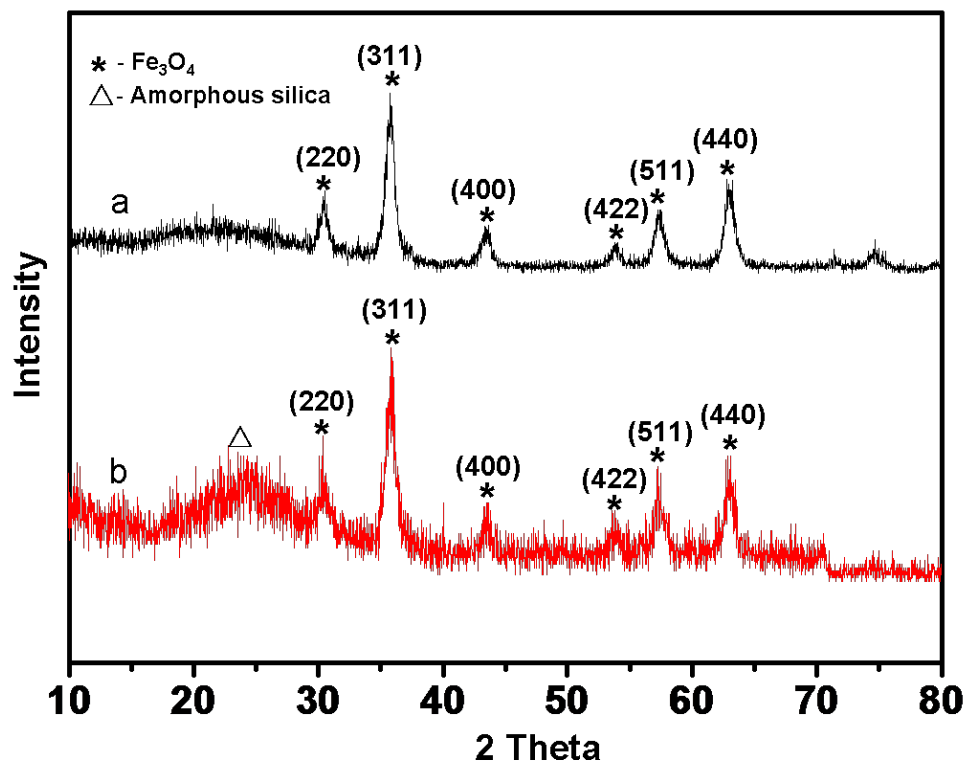


Figure S3. XRD patterns of (a) the oleic acid modified Fe₃O₄ nanoparticles and (b) Fe₃O₄/SiO₂ composite particles obtained after addition of the Tween-80 modified aggregates (80 nm) into the pre-hydrolyzed Stöber system for 40 min. It was identified that the pattern of the Fe₃O₄/SiO₂ nanoparticles presented the same characteristic peaks of cubic inverse spinel structure as those of the Fe₃O₄ nanoparticles, indicating that there was no change in crystal structure of the Fe₃O₄ nanoparticles before and after the silica coating. The broad peak appeared at 23° suggests the existence of amorphous silica in the coating layer (see Ref. 11 in the text).

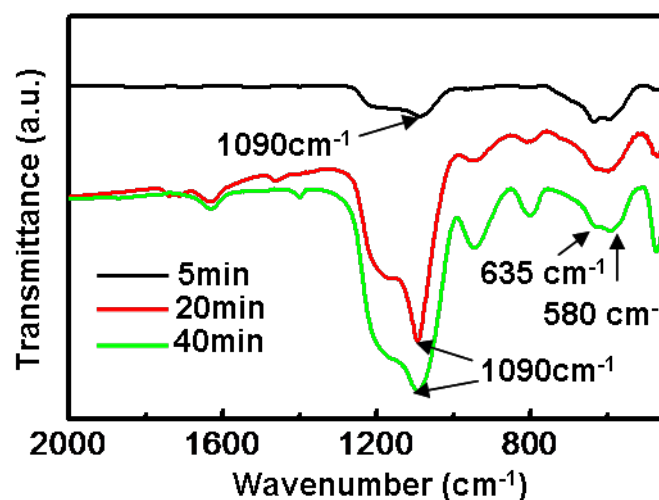


Figure S4. FTIR spectra of the Fe₃O₄/SiO₂ composite particles obtained after addition of the Tween-80 modified aggregates (80 nm) into the pre-hydrolyzed Stöber system for 5, 20 and 40 min. In all the spectra, the characteristic stretching vibrations of Fe-O at 635 and 580 cm⁻¹ were set at the same intensity. When the time of silica coating was prolonged from 5 to 20 and 40 min, an obvious increase in intensity of Si-O stretching vibration at 1090 cm⁻¹ was observed, suggesting the increased content of silica and thus increased thickness of the silica shell of the composite particles (see Ref. 12 in the text).

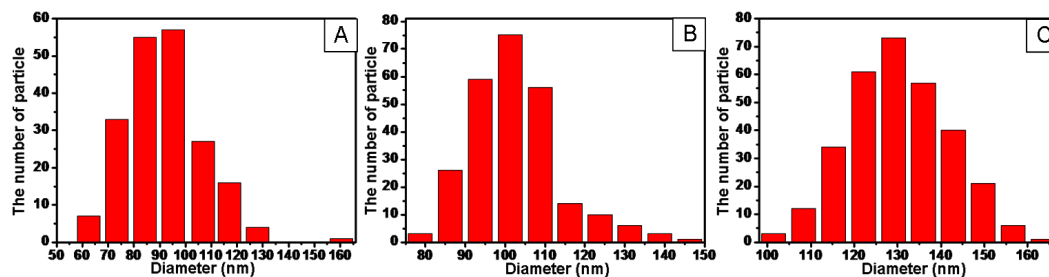


Figure S5. Histograms of size distributions of the Fe₃O₄/SiO₂ composite nanoparticles obtained after addition of the Tween-80 modified aggregates (80 nm) into the pre-hydrolyzed Stöber system for (A) 5, (B) 20 and (C) 40 min. The numbers of the particles used to get the histograms of size distributions were (A) 200, (B) 253 and (C) 308 respectively.

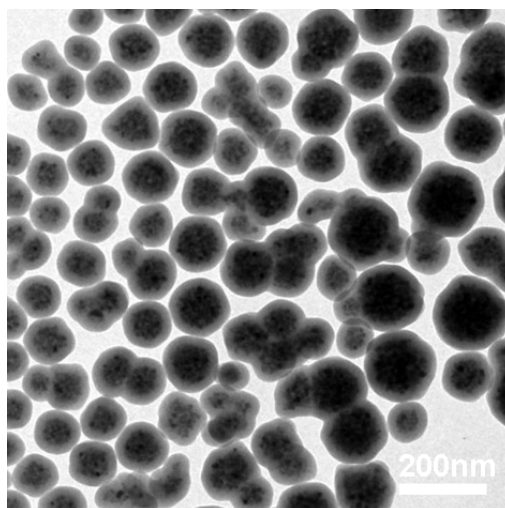


Figure S6. TEM image of the $\text{Fe}_3\text{O}_4/\text{SiO}_2$ composite particles prepared by introducing SDS modified aggregates (80 nm) into the Stöber system pre-hydrolyzed for 20 min. The shape of the composite particles was less regular and their size was not uniform, possibly due to the poor stability of the SDS modified aggregates in the pre-hydrolyzed Stöber system.

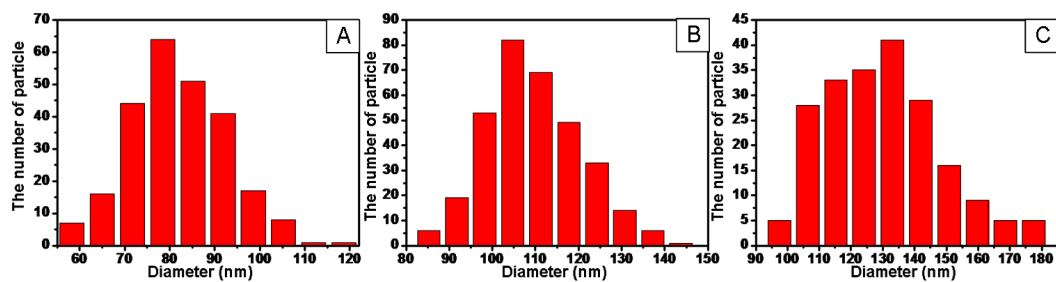


Figure S7. Histograms of size distributions of the Fe₃O₄/SiO₂ particles prepared by using the different sized aggregates after 40 min of the silica coating. (A) 50, (B) 70 and (C) 90 nm. The numbers of the particles used to get the histograms of size distributions were (A) 250, (B) 332 and (C) 206 respectively.