

Fe₃O₄@SiO₂-NH₂ functionalized nanoparticles as a potential contrast agent in magnetic resonance

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Magnetization curves at 300 K of Fe₃O₄@SiO₂-NH₂ during the reheating process

The magnetization of the Fe₃O₄@SiO₂-NH₂ sample was rescaled using the weight fraction of Fe₃O₄ in the system. For this adjustment, the weight fraction 0.75261 (75.3%) for Fe₃O₄ in Fe₃O₄@SiO₂-NH₂ was applied. Measured magnetization M_{measured} in emu/g of the total sample was adjusted by dividing it by 0.75261 to obtain the specific magnetization of Fe₃O₄: $M_{\text{Fe}_3\text{O}_4} = M_{\text{measured}}/0.75261$ as shown in Figure S1. The obtained values for saturation magnetization ($M_s = 27.5$ emu/g Fe₃O₄) and coercive field ($H_c = -0.078$ Oe) indicate that no significant amount of maghemite has formed in the Fe₃O₄@SiO₂-NH₂ sample. Although the saturation magnetization is low compared to bulk Fe₃O₄ (92-100 emu/g), this reduced value can be attributed to factors such as the nanometric size of the particles and the SiO₂ coating, which limit the effective magnetization. Additionally, the extremely low coercive field is characteristic of superparamagnetic materials or Fe₃O₄ nanoparticles, opposing the presence of maghemite, which typically exhibits a higher coercivity. These results strongly suggest that the sample contains pure Fe₃O₄ with no significant transformation to maghemite. For definitive confirmation, additional techniques such as Mössbauer Spectroscopy could be employed; however, the current data are consistent with the stability of Fe₃O₄ in the sample with no evidence of oxidation to maghemite.”

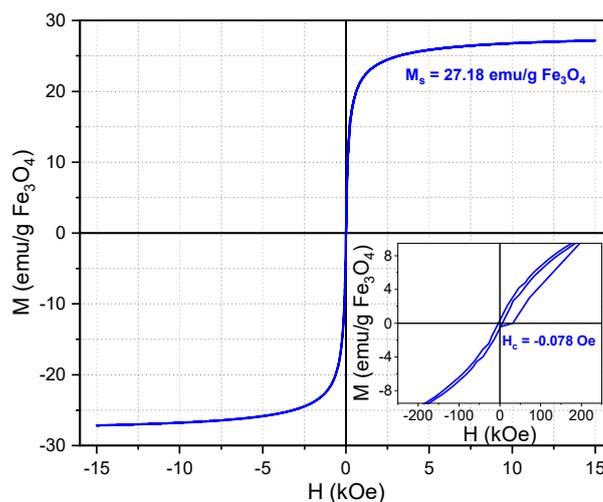


Figure S1. Magnetization curves at 300 K of Fe₃O₄@SiO₂-NH₂ during the reheating process.

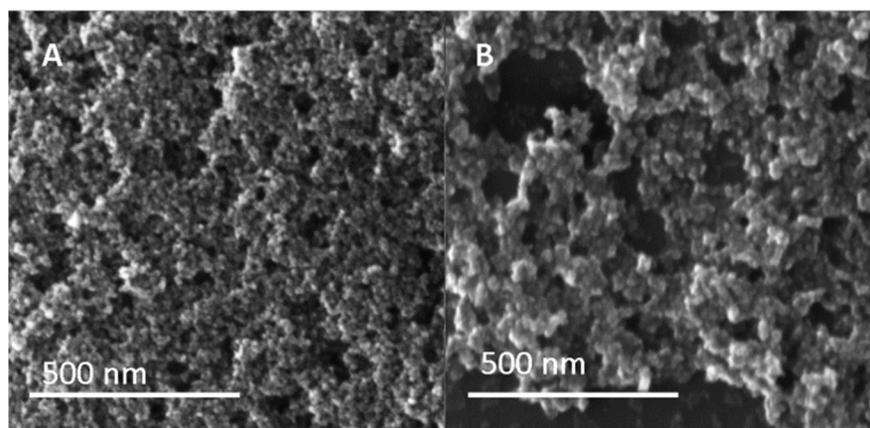


Figure S2. Representative SEM Images of the surface granularity of Fe_3O_4 (a) and (b) $\text{Fe}_3\text{O}_4@/\text{SiO}_2\text{-NH}_2$ nanoparticles.

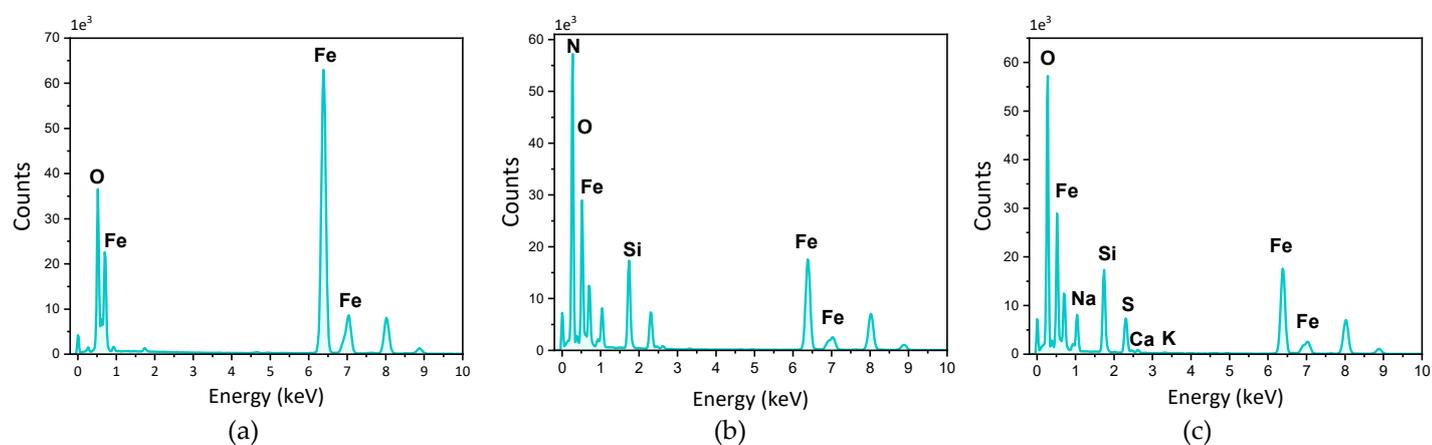


Figure S3. EDX of Fe_3O_4 (a), $\text{Fe}_3\text{O}_4@/\text{SiO}_2\text{-NH}_2$ nanoparticles (b) and $\text{Fe}_3\text{O}_4@/\text{SiO}_2\text{-NH}_2/\text{P-88}$ nanoparticles (c).

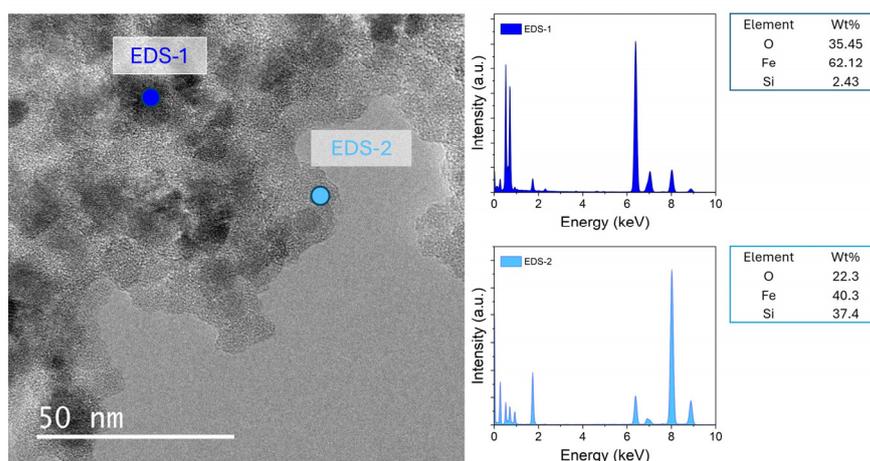


Figure S4. TEM image and EDX spectra with elemental composition in two zones of the nanoparticles: EDS-1 in the core and EDS-2 on the $\text{SiO}_2\text{-NH}_2$ coating.