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Preparation and Magnetic Comparison of Silane-Functionalized Magnetite Nanoparticles

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Silane-modified magnetite nanoparticles (NPs) were synthesized by chemical coprecipitation and subsequent surface modification with 3-aminopropyltriethyloxysilane (APTES) and mercaptopropyltriethoxysilane (MPTES). Functionalized Fe₃O₄ nanospheres with an average diameter of 25 ± 5 nm were clearly characterized by good dispersion, good morphology, accurate composition, and excellent optical properties, as well as maximized saturation magnetization. The results confirm that the functionalized NPs retain most of their original saturation magnetization. The saturation magnetization (M_s) of the Fe₃O₄ NPs was found to be 64.4 emu g⁻¹ at 300 K and 71.8 emu g⁻¹ at 5 K. Likewise, the APTES-coated and MPTES-coated Fe₃O₄ NPs demonstrated slight decreases in their saturation magnetization and paramagnetism at 300 K, and the decrease in magnetic property agreed with previous reports. Therefore, the negligible loss in magnetic property indicates the potential of these silane-functionalized magnetite NPs for further biochemical manipulation and assembly on surface-tailored NPs for biosensor applications.

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