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Easy Synthesis and Magnetic Properties of Iron Oxide Nanoparticles

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Easy preparation of iron oxide nanoparticles [5- and 11-nm maghemite (γ-Fe_2O_3) and 19-nm magnetite (Fe_3O_4)] by thermal decomposition of $Fe(CO)_5$ in the presence of residual oxygen of the system and by consecutive aeration were investigated by TEM/HRTEM, XRD, and Mössbauer spectroscopy. Also, the magnetic properties of the nanoparticles were studied by SQUID magnetometer and optical microscopy. It was suggested that the intermediate iron oxide nanoparticles (before aeration) were formed by the competing processes of oxidation and crystal growth after decomposition of $Fe(CO)_5$. At room temperature, the aerated 5-nm particles were superparamagnetic without interaction among the particles, whereas the 19-nm particles were ferrimagnetic. The 11-nm iron oxide nanoparticles were superparamagnetic with some interactions among the particles.