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Size dependent magnetic properties of magnetite (Fe_3O_4) nanoparticles.[1] SEONGJIN JANG, SAVAS DELIKANLI, HAO ZENG, University at Buffalo-SUNY — Magnetism of magnetite (Fe_3O_4) nanoparticles was studied as a function of the particle size. Fe_3O_4 nanoparticles with different size from 3 nm to 10 nm were synthesized by high temperature organic solution phase method. Hysteresis loops of all the particles showed superparamagnetic behavior at room temperature. The blocking temperature (T_B) decreases with decreasing particle size. All hysteresis loops were fitted by the Langevin's function, where the saturation magnetization (M_s) was extracted. M_s was further deduced by using the saturated moment and accurately measured mass of the particles. The two methods agree with each other excellently. M_s decreases as the particle size is decreased, and is in general much smaller than that of bulk. M_s shows a sharp drop with increasing temperature at low temperatures and deviates from the $T^{3/2}$-law. This behavior is attributed to competing ferromagnetic and antiferromagnetic exchange interactions which contribute differently at the surface and interior of the particles.

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