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Increase of magnetic hyperthermia in nanochains of magnetite nanoparticles

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Magnetic nanoparticles are being widely investigated for their great potential applications in drug transport, magnetic resonance imaging, and the treatment of magnetic hyperthermia. Magnetic hyperthermia consists of the destruction of cancer cells by heat, which is dissipated by nanoparticles. The assembly in the form of chains can increase the heating capacity of the nanoparticles, due to the effect of the dipole interaction and magnetic anisotropy. In this work, the Monte Carlo-Metropolis method is used to calculate the hysteresis cycles of various systems of nanochains at low temperature (T = 5 Kelvin), composed of spherical magnetite nanoparticles. The different concentrations and distribution of the anisotropy axes are considered randomly and constrained in a solid of 20 degrees cone. The nanochains with random anisotropy show an increase in heating, for the entire range of applied magnetic field. Anisotropy restricted nanochains show the maximum heating capacity, but only for high magnetic field values, observing a blocking effect caused by the assembly of the system in the form of nanochains. Finally, these results show the potential of magnetic nanochains to improve the treatment of magnetic hyperthermia.

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