

# Magnetic Properties, Self-Temperature Rising Characteristics, and Biocompatibility of NiFe<sub>2</sub>O<sub>4</sub> Nanoparticles for Hyperthermia Applications

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This paper reports first on the very promising self-heating and temperature rising characteristics of solid-state NiFe<sub>2</sub>O<sub>4</sub> nanoparticles for hyperthermia applications. NiFe<sub>2</sub>O<sub>4</sub> nanoparticles were prepared by using both the “high temperature thermal decomposition method (HTTD)” and the “newly modified sol-gel” methods. The magnetic properties and cell-cytotoxic properties of the synthesized NiFe<sub>2</sub>O<sub>4</sub> nanoparticles were investigated to consider these nanoparticles for *in vivo* hyperthermia applications. The saturation magnetic moments measured by a high sensitive SQUID were between 43.0 and 47.6 emu/g. The cell survival rates of NiFe<sub>2</sub>O<sub>4</sub> and chitosan coated NiFe<sub>2</sub>O<sub>4</sub>, which were determined by MTT assay, around 85 % and 98.8 %, respectively. The maximum self-heating temperature induced by our specially designed RF-MRI modified L-C circuit was 47.3 °C and the frequency and magnetic field product,  $H_0 f$  was  $1.07 \times 10^9 \text{ Am}^{-1} \text{ s}^{-1}$ .

*Index Terms*—Biocompatibility, hyperthermia, NiFe<sub>2</sub>O<sub>4</sub> nanoparticles, self-heating.