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Core-Shell Structured Magnetic Nanoparticles for Efficient Hyperthermia Cancer Treatment

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Abstract : Conversion of electromagnetic energy into heat by nanoparticles (NPs) has the potential to be a powerful, non-invasive technique for biomedical applications such as magnetic fluid hyperthermia, drug release, disease treatment and remote control of single cell functions, but poor conversion efficiencies have hindered practical applications so far. In this paper, an attempt has been made to increase the efficiency of magnetic, thermal induction by NPs. To increase the efficiency of magnetic, thermal induction by NPs, one can take advantage of the exchange coupling between a magnetically hard core and magnetically soft shell to tune the magnetic properties of the NP and maximize the specific absorption rate, which is the gauge of conversion efficiency. In order to examine the tunability of magnetocrystalline anisotropy and its magnetic heating power, a representative magnetically hard material ($CoFe_2O_4$) has been coupled to a soft material ($Ni_{0.5}Zn_{0.5}Fe_2O_4$). The synthesized NPs show specific absorption rates that are of an order of magnitude larger than the conventional one.

Keywords : magnetic nanoparticles, surface functionalization of magnetic nanoparticles, magnetic fluid hyperthermia, specific absorption rate
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