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Mössbauer analysis and induction heating evaluation of grapes like FZ@MWCNT towards cancer treatment

Chandi Charan Dey [a], Ayan Mallick [a], Abhik Sinha Mahapatra [b], Madhumita Dalal [a], Anna Bajorek [c], Jean-Marc Greneche [d], Raghumani Singh Ningthoujam [e], Pabitra Kumar Chakrabarti [a]

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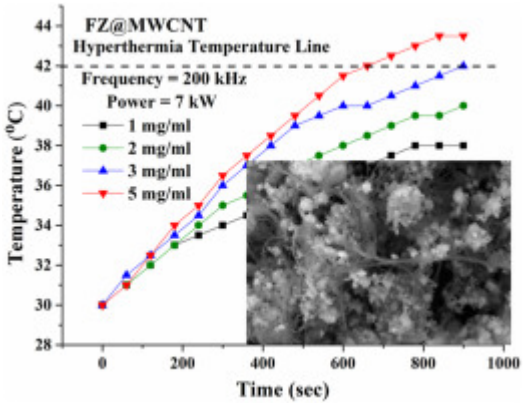
Highlights

- γ-Fe_2O_3 is prepared through an unconventional cost-effective technique.
- π conjugate interaction of nanoparticles with that of the MWCNT surface i.e. magnetophoresis interaction bond is identified.
- Mössbauer spectrometry at 77 and 300 K confirm the reduction of dipolar interaction to adopt the LRT theory.
- Néel's relaxation makes the dominant position for hyperthermia.
- Inductive heating rate of FZ@MWCNT reflects their high potential for hyperthermia therapy.

Abstract

We have successfully modified the synthesis of γ-Fe_2O_3 and ZnO in a variety of potential matrices, like as multiwall carbon nanotubes (MWCNT) and graphene oxide (GO), referred to as FZ@MWCNT and FZ@MWCNT-GO. X-ray diffraction (XRD) and scanning electron microscopy (SEM) were performed for phase formation and morphological analysis. Phase purity and superparamagnetic environment of maghemite and FZ@MWCNT were investigated by ^{57}Fe Mössbauer spectrometry at 77 and 300 K, confirming the reduction of dipolar interaction. Induction heating of γ-Fe_2O_3, FZ@MWCNT and FZ@MWCNT-GO was analysed at various concentrations of nanoparticles to investigate the suitability of this nanocomposite for hyperthermia application. Ironically, the inductive heating rate of FZ@MWCNT at 3 mg/ml concentration is reflecting its high potential for hyperthermia therapy in cancer treatment.

Graphical abstract



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Keywords

MWCNTs; Graphene oxide; Magnetic properties; Mössbauer analysis; Hyperthermia

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