Mn-Zn ferrite nanoparticles for application in magnetic hyperthermia

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Z\(_{0.8}\)Mn\(_{0.2}\)Fe\(_2\)O\(_4\) nanoparticles (NPs) were prepared by a high temperature thermal decomposition. The crystal structure was found to be cubic spinel with space group \(Fd-3m\) and lattice constant (\(a_0\)) to be 8.4103 Å by using a Rietveld refinement analysis. The saturation magnetization (\(M_s\)) and coercivity (\(H_c\)) of the NPs were 83.2 emu/g and 32.7 Oe, respectively. The self-heating temperature of the NPs was found to be 110 °C at 50 kHz under an applied field of 250 Oe. NPs was used for hyperthermia therapy nude mice. SKBR3 breast cancer cells were xenografted to the abdomen of two nude mice. It was effective to breast cancer cell death, but tumor sizes were not increased. We obtained the Mössbauer spectra (A, B sites) of the NPs under zero magnetic field and under high external field 50 kOe at 4.2 K. The magnetic hyperfine field (\(H_{hf}\)) of the NPs under high external field 50 kOe at 4.2 K were analyzed 513 and 432 kOe for A and B sites, respectively.

Fig. 6. Mössbauer spectra of Z\(_{0.8}\)Mn\(_{0.2}\)Fe\(_2\)O\(_4\) (a) at 4.2 K under zero magnetic field and (b) at 4.2 K with 50 kOe external field.