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Effect of Changing Iron Content and Excitation Frequency on Magnetic Particle Imaging Signal: A Comparative Study of Synomag® Nanoparticles

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Abstract : Magnetic nanoparticles (MNPs) are widely used to facilitate magnetic particle imaging (MPI) which has the potential to become the leading diagnostic instrument for biomedical imaging. This comparative study assesses the effects of changing iron content and excitation frequency on point-spread function (PSF) representing the effect of magnetization reversal. PSF is quantified by features of interest for MPI: i.e., drive field amplitude and full-width-at-half-maximum (FWHM). A superparamagnetic quantifier (SPaQ) is used to assess differential magnetic susceptibility of two commercially available MNPs: Synomag®-D50 and Synomag®-D70. For both MNPs, the signal output depends on increase in drive field frequency and amount of iron-oxide, which might be hampering the sensitivity of MPI systems that perform on higher frequencies. Nevertheless, there is a clear potential of Synomag®-D for a stable MPI resolution, especially in case of 70 nm version, that is independent of either drive field frequency or amount of iron-oxide.

Keywords : magnetic nanoparticles, MNPs, differential magnetic susceptibility, DMS, magnetic particle imaging, MPI, magnetic relaxation, Synomag®-D
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