**Parametric analysis of magnetic nanostructures for hyperthermia applications**

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**Text**

Recently, magnetic nanostructures (MNs) have been intensively studied for future application in   
cancer treatment, thanks to the possibility of inducing cell apoptosis via hyperthermia or cell   
membrane mechanical stimulation [1]. Focusing on hyperthermia, when an external ac magnetic   
field is applied to an ensemble of MNs dispersed in a tissue, different physical phenomena can   
concur to heat generation, e.g. Néel relaxation, Brownian relaxation, hysteresis and eddy current   
losses, with relative contribution strongly dependent on the size and physical properties of MNs.   
Here, we present a micromagnetic modelling analysis of permalloy MNs with variable shape (disk,   
ring, cube, pillar, sphere), for possible application in magnetically mediated hyperthermia. A   
parametric study is performed by varying aspect ratio and size (up to 1 μm), with the aim of finding   
the optimal conditions for the maximization of the specific heating capabilities. Hysteresis losses,   
being the predominant heating contribution for the considered MNs, are calculated by means of a   
3D GPU-parallelized micromagnetic code, implementing an FFT approach for the magnetostatic   
field evaluation and a Cayley transform based scheme for the time integration. The numerical   
results are validated by comparison to experimental data, obtained for the specific case of permalloy   
nanodisks (diameter from 200 nm to 650 nm), prepared via polystyrene nanosphere self-assembling.   
  
1) K. Simeonidis et al., Sci. Rep. 6, 38382 (2016).