The influence of magnetic particle shells on magnetic heating in Pickering emulsions

R. Bielas,[1] T. Hornowski,[1] K. Paulovičová,[2] M. Rajňák,[2,3] and A. Józefczak[1]

[1] *Faculty of Physics, Adam Mickiewicz University in Poznań, Uniwersytetu Poznańskiego 2, 61-614 Poznań, Poland*

[2] *Institute of Experimental Physics, Slovak Academy of Sciences, Watsonova 47, Košice 040 01,*

[3] *Faculty of Electrical Engineering and Informatics, Technical University of Košice, Letná 9, 04200 Košice, Slovakia*

Magnetic colloidal systems heated under alternating magnetic fields have attracted scientific attention mainly because of potential applications of such generated local temperature elevation in magnetic hyperthermia therapy of cancers. The mechanism of heating due to magnetic relaxation and hysteresis losses is generally well-known, and the effort is being progressively directed to provide knowledge of how different factors affect heating efficiency including the type of the material of particles, their sizes, and the parameters of applied magnetic fields. However, we show that another factor can be the solidity of particle shells when so-called Pickering emulsion droplets are placed in the alternating magnetic field.

In our works, the temperature rise in oil-in-oil emulsions stabilized with magnetic particles of different sizes varied for the different appearance of emulsion. The emulsions with droplets not fully-covered by particles demonstrated better heating efficiency than the emulsions with stable droplets (1). It was explained by deteriorating magnetic interactions when particles were densely arranged on the droplet surface and the high temperature potentially remained in nanoscale inside the droplets enclosed by particles. What is more, the temperature observed during cooling down was also different what indicated again that the solidity of the particle shell can influence the heat transfer from the inside the droplet to the surrounding medium (2). The presented study can bring the new applications of magnetic Pickering emulsions in local heating such as the formation of colloidal capsules (3).

References:

[1] R. Bielas, T. Hornowski, K. Paulovičová, M. Rajňák, A. Józefczak, The effect of magnetic particles covering the droplets on the heating rate of Pickering emulsions in the AC magnetic field, *Journal of Molecular Liquids* 320 (2020): 114388

[2] R. Bielas, A. Józefczak, The Effect of Particle Shell on Cooling Rates in Oil-in-Oil Magnetic Pickering Emulsions, *Materials* 13.21 (2020): 4783

[3] R. Bielas, D. Surdeko, K. Kaczmarek, A. Józefczak, The potential of magnetic heating for fabricating Pickering-emulsion-based capsules, *Colloids and Surfaces B: Biointerfaces* 192 (2020): 111070

The work was supported by Polish Science National Center through the project no. 2019/35/N/ST5/00402.