Propagation of ultrasonic wave in magnetic Pickering emulsion under DC magnetic field

Bassam Jameel,[1] Rafał Bielas,[1] Tomasz Hornowski,[1] and Arkadiusz Józefczak[1]

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

Pickering emulsion is an emulsion stabilized by solid particles accumulated at the surface of droplets. It is also possible to create stable Pickering emulsion stabilized by ferromagnetic iron oxide nanoparticles to make them susceptible to magnetic fields [1]. Such type of emulsion has received great research interest in recent years because it has generated and hold promise for a variety of practical applications in fields such as medicine, the food industry, the oil industry, and biofuel processing. In the context of many applications, it is important to study the structural properties of particle-stabilized emulsions. However, their real-time characterization especially under external stimuli such as magnetic fields is generally challenging. We use a convenient method to control the properties of magnetic particle-stabilized emulsions using the ultrasound technique. In the experiments, we investigated the velocity and attenuation of ultrasound using ultrasonic spectroscopy based on FFT spectral analysis of the received pulses as a function of magnetic particle concentration and field intensity. By using consecutive action of ultrasound and electric fields we prepared oil-in-oil emulsions with droplets fully covered by magnetite particles. After the application of DC magnetic the structure of the emulsion alteration and this process was characterized by acoustic spectroscopy. The formation of chain structures by magnetite-stabilized silicone oil droplets affects the velocity and attenuation of ultrasonic waves, and this influence had depended on the concentration of magnetic nanoparticles, droplets size, and the intensity of the magnetic field. The parameters of magnetic emulsion can be monitored by broadband acoustic method.

References:

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