**Nanoparticles for Ultrasonic and Magnetic Applications**

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**Abstract.**

Nanoparticles are used for multiple purposes in many different fields but biomedical applications have received particular attention. Nanoparticles are used in therapies using a magnetic field and ultrasound. Various nanosystems have been explored for ultrasound imaging, photoacoustic imaging, ultrasound therapy (hyperthermia, thermoablation), ultrasound-triggered drug releasing. The nanoparticles have been also tested for magnetic hyperthermia, magnetic drug targeting or contrast agent for magnetic resonance imaging. Recently, a lot of effort has been put into combining more than one method into one treatment. For example, nanoparticles have the dual ability to act as both magnetic and sonosensitizer agents in hyperthermia (controlled increase of temperature in tissues up to 42-45°C). The nanoparticles become the source of supplementary ultrasound attenuation which consequently leads to the increase of temperature. Because of their sensitivity to magnetic field they are also the source of heat in magnetic hyperthermia. Magnetic and ultrasonic heating may work synergistically to produce a more efficient treatment. The coupling of magnetic and ultrasonic hyperthermia gives the possibility for developing the new, innovative sonomagnetic thermal therapy. Nanoparticles are also an excellent material for theranostic applications.

K. Kaczmarek, T. Hornowski, I. Antal, M. Timko, A. Józefczak, Magneto-ultrasonic heating with nanoparticles, J. Magn. Magn. Matter., 474 (2019) 400-405. DOI: 10.1016/j.jmmm.2018.11.062

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