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NANOPARTICLE-MEDICATED ULTRASONIC HEATING FOR BIOMEDICAL APPLICATIONS

Invited Paper

Hui-Jiuan Chen and Dongsheng Wen
Queen Mary University of London
School of Engineering and Materials Science
London, E1 4NS, U.K.

SUMMARY: An experimental investigation on ultrasonic heating effect of different nanoparticle dispersions is conducted in this work to examine the feasibility of nanoparticle-mediated ultrasonic therapy. Different sized spherical-shaped gold nanoparticles (GNPs) are fabricated by the citrate reduction method with the aid of an ultrasonic device. The heating response of different concentrations of GNP dispersions under an external ultrasound irradiation is revealed, and compared with other nanoparticles including alumina and nickel. The results clearly show that nanomaterials have great capability to focus ultrasonic irradiation even at very low concentrations. Up to four-fold increase in the temperature rise rate is observed for GNP at a concentration of 150 μM/L. The effect of GNPs is much higher than that of alumina and nickel nanoparticles. Further discussion shows that possible reasons for the rapid temperature increase shall be related to the enhanced cavitation effect and modified thermal-physical properties of the base fluid.