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Electronic measurements in an alternating magnetic field (AMF) for studying magnetic nanoparticle hyperthermia Z. BOEKELHEIDE, Z. A. HUSSEIN, S. HARTZELL, Lafayette College — Magnetic nanoparticle hyperthermia is a promising cancer treatment in which magnetic nanoparticles are injected into a tumor and then exposed to an alternating magnetic field (AMF). This process releases heat and damages tumor cells, but the exact mechanisms behind the effectiveness of this therapy are still unclear. Accurate sensors are required to monitor the temperature and, potentially, other parameters such as magnetic field or mechanical stress during clinical therapy or lab research. Often, optical rather than electronic temperature sensors are used to avoid eddy current self-heating in conducting parts in the AMF. However, eddy current heating is strongly dependent on the size and geometry of the conducting part, thus micro- and nano-scale electronics are a promising possibility for further exploration into magnetic nanoparticle hyperthermia. This presentation quantitatively discusses the eddy current self-heating of thin wires (thermocouples) and will also present a proof of concept thin film resistive thermometer and magnetic field sensor along with measurements of their eddy current self-heating. The results show that electronic measurements are feasible in an AMF with both thin wires and patterned thin film sensors under certain conditions.

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