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Thermocouples in an alternating magnetic field (AMF) for studying magnetic nanoparticle hyperthermia S. HARTZELL, Z. BOEKELHEIDE, Lafayette College — Magnetic nanoparticle hyperthermia, a method of cancer therapy, is currently a subject of active research. A critical parameter during therapy or laboratory research is the temperature of the system (tissue or nanoparticle suspension). Thermocouples are affordable and ubiquitous temperature sensors which could be used in this capacity; however, their metallic nature results in self-heating due to eddy currents when placed in an AMF. This presentation will quantitatively discuss calculations and measurements of the self-heating of three common types of thermocouples. Type T, K, and E thermocouples of both thin (40 gauge) and thick (20 gauge) wires were tested in a range of applied magnetic field magnitudes (235 kHz, 0-0.4 T rms). Among the thermocouples, all three types demonstrated large self-heating in 20 gauge wires. For the 40 gauge wires, type K showed large self-heating, while type T showed small but significant self-heating and type E showed no significant self-heating in comparison to the background. Our results indicate that thin type E thermocouples can be accurately used as temperature sensors in an AMF environment similar to the one used here, and type T thermocouples may be appropriate under conditions with lower magnetic field strength or frequency.

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