Magnetic heating of electrospun textiles

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Textile materials, although well established, can be funcionalized by incorporating various additives within the inter-fiber spaces or on fiber surfaces, including magnetic nanoparticles, which have been shown to support applications such as acoustic and electromagnetic shielding [1]. Beyond traditional yarn-based textile fabrication methods, electrospinning enables the production of nano- and microfibers from a wide range of polymers. In this technique, electrostatic forces draw polymer droplets into continuous fibers that can be assembled into nonwoven textile structures. Electrospun fibers can be fabricated from synthetic or bio-based polymers, the latter offering inherent biocompatibility. Furthermore, polymer blending and nanoparticle incorporation allow for the formation of multifunctional fibers, including magnetically responsive nanocomposites.

This study investigates magnetically modified textiles with respect to their hyperthermia-related behavior. Electrospun textiles with different composition including various concentration of magnetic material were prepared. Additionally, the influence of magnetic nanoparticle distribution within the textile structure on heat generation under oscillating and rotating magnetic fields was examined. The heating efficiency and spatial temperature distribution in tissue-mimicking phantoms were measured to show the textiles' potential for biomedical hyperthermia applications.

References:

[1] E. Prajwos, R. Bielas, E. Nowicka, D. Nowicka, A. Kicińska-Jakubowska, I. Šafařík, P. Kopčanský, B. Dolník, A. Józefczak, Natural Textiles Modified by Magnetic Iron Oxide Particles for Acoustic and Electromagnetic Shielding, Journal of Natural Fibers 23(1) (2026)

This work is supported by project no. 2023/50/O/ST3/00062 (PRELUDIUM BIS) of the Polish National Science Centre.