CORE-SHELL NANOCOMPOSITES FOR THERANOSTATIC APPLICATIONS

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Cancer is one of the most common diseases of the twenty-first century. Poland ranks 7th in Europe in terms of cancer incidence. Melanoma mainly affects Europeans, accounting for around 44.1% of cases, with approximately 21% of men and 48% of women affected. Therefore, there is a need to develop non-toxic nanostructures that can effectively treat melanoma. One of these solutions is nanostructures such as superparamagnetic iron oxides (SPIONs), whose surfaces can be easily modified to create a core–shell structure, where the core is magnetic and the shell increases the specific surface area.

The crystallographic structure of the shell can also be modified, particularly by doping it with different elements that introduce unique properties, such as zinc and boron. Zinc is well known for its antibacterial properties, and boron for its anti-inflammatory properties. These components have gained significant interest as functional platforms in various fields, including targeted therapy, drug delivery, and heat generation in magnetic hyperthermia applications.

The SPION-based nanocomposites were synthesized using the co-precipitation method, which allowed the formation of a layer from an inorganic compound and its doping with the selected elements. The morphology, crystallinity, colloidal stability, and heat generation under magnetic hyperthermia were investigated. The Specific Loss Power (SLP) values of the obtained materials were comparable to those reported for similar structures in the literature.

Keywords: SPIONs nanocomposites, zinc-doped structures, boron-doped structures, melanoma, magnetic nanoparticles