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Abstract of doctoral thesis

Preparation and characterisation of biocomposites based on biopolymers and nanomaterials doped with rare earth ions.

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One of a current challenge of biomedicine related to biomaterials is to obtain a reliable method of a bone reconstruction. Although, there is commonly known a list of surgical procedures showing how to rebuild the bone structure, but there are still needed new and better biomaterials. New materials should strongly promote cell culture viability as well as be functional and useful. The aim of this dissertation was to develop this branch of science.

Human bone is a complex structure, built by collagen fibre and apatite crystals that are located inside. The main topic of the presented study was to obtain as well as physicochemical characterisation of composites based on the nanosized apatite and biopolymers. Finally, the obtained composites could be dedicated for a biomedical application. The doctoral thesis includes five research articles, previously published in the international scientific journals. Three of the papers described the silicate-substituted apatite doped with europium(III) ions. The photoluminescence properties were studied as a function of optical ion concentration as well as co-dopand ion presence and its concentration. The strontium(II), silver(I) and bismuth(III) ions were chosen to improve the biological features of the studied materials. The prepared nanocrystals were used to obtain the final composites with the polylactide and polytetrafluoroethylene as matrices.

The physicochemical characterisation includes X-ray Powder Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Absorption Spectrometry (AAS) and Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) as well as photoluminescence measurements: emission, excitation, and luminescence kinetics. The preliminary biological study was carried out suggesting possibility of further biomedical application.