Annals of the Academy of Romanian Scientists
Series on Physics and Chemistry Sciences
ISSN 2559-1061 Volume 6, Number 2/2021

ADVANCED NANOMATERIALS AND COATED SURFACES FOR ORTHOPEDIC IMPLANTS – A REVIEW

Reka BALINT[1], Aurora MOCANU[1], Gheorghe TOMOAIA[2,3], Sorin RIGA[1,3], Maria TOMOAIA-COTISEL[1,3,*]

Abstract. Critical-sized defects in bone induced by trauma have in numerous presented cases difficult challenges to the current treatment for bone repair. The main purpose of bone tissue engineered scaffolds is to use advanced materials to promote the natural healing process of bone which does not easily occur in critical-sized defects or on metallic implants. A synthetic bone scaffold and a coating on Ti implants must be biocompatible and biodegradable to allow the native tissue integration, and mimic the chemical composition and structure of native bone. In addition to being physically and chemically biomimetic, an ideal scaffold and the coating layers on metallic implants must be capable of releasing essential physiologic elements, like Mg, Zn, Sr and Si, and also containing bioactive molecules (e.g., collagen, COL) to accelerate extracellular matrix production and tissue integration. Also, these advanced materials might be doped with drugs (e.g., antibiotics, such as vancomycin) to prevent undesired biological response such as infections, especially with Staphylococcus aureus, *S. aureus*. Various biomaterials include hydroxyapatite (HAP) ceramics or multi-functional hydroxyapatite substituted with Mg, Zn, Sr and Si, mf-HAP, polymers, such as poly lactic acid (PLA, approved for medical applications by Food and Drug Administration, US FDA, and collagen, or their mixtures as biomimetic composites which have been investigated for their potential as bone scaffold materials and coatings on metallic implants. This article briefly reviews the physical and chemical characteristics of used advanced materials and describes the key-technologies in mimicking the physical and chemical environment of bone using synthetic materials, and provides an over view of local drug delivery as it pertains to bone tissue engineering.

Keywords: hydroxyapatite, multi-functional hydroxyapatites, biomimetic composites, orthopedic (medical) implants

https://doi.org/10.56082/annalsarsciphyschem.2021.2.53

[1] *Babeş-Bolyai University, Faculty of Chemistry and Chemical Engineering, Research Center of Physical Chemistry, 11 Arany Janos Str., RO-400028, Cluj-Napoca, Romania*
[2] *Iuliu Haţieganu University of Medicine and Pharmacy, Department of Orthopedics and Traumatology, 47 General Traian Moşoiu Str., RO-400132, Cluj-Napoca, Romania*
[3] Academy of Romanian Scientists, 3 Ilfov Str., RO-050044, Bucharest, Romania
[*] *Corresponding author: Maria Tomoaia-Cotisel, mcotisel@gmail.com*