BRAMAT 2024
13TH INTERNATIONAL CONFERENCE ON MATERIALS SCIENCE & ENGINEERING
Transilvania University of Brasov - Romania
Materials Science and Engineering Faculty

ANTIMICROBIAL MATERIALS WITH PRINTABLE FEATURES FOR THE FABRICATION OF IMPLANTABLE DEVICES

Aura – Cătălina Mocanu[1], Florin Miculescu[1], Ștefan Ioan Voicu[2,3], Mădălina Andreea Pandele[2,3], Sorina Dondea[1], Ștefan Alexandru Lăptoiu[1]

[1] National University of Science and Technology POLITEHNICA Bucharest, Department of Metallic Materials Science, Physical Metallurgy, 313 Splaiul Independentei, 060042, District 6, Bucharest, Romania, e-mail: mcn_aura@hotmail.com
[2] National University of Science and Technology POLITEHNICA Bucharest, Department of Analytical Chemistry and Environmental Engineering, 1-7 Gh. Polizu Str., Polizu campus, 011061, District 1, Bucharest, Romania;
[3] National University of Science and Technology POLITEHNICA Bucharest, Advanced Polymer Materials Group, 1-7 Gh. Polizu Str., Polizu campus, 011061, District 1, Bucharest, Romania;

Keywords: printable composite materials, antimicrobial features, biomedical applications

Abstract: Dedicated studies for the manufacturing of implantable devices with patient-customized characteristics have impacted the targeted field in recent decades for the incorporation of antibiotics (ATB) into their composition in order to reduce the implantation-risk-associated [1]. Due to the constant evolution of composite (bio)materials, this study targeted the development of composite filaments with printable features with/-out antimicrobial properties [2]. The selected reinforcement materials, namely micrometric biogenic hydroxyapatite (BHA, particles <40 μm) and micrometric graphene nanoplatelets (GnP, grade M) [3], were homogenized with/-out ATB into the polylactic acid (PLA) matrix by mechanical and thermal means at modulated ratios. The obtained mixtures were converted into granules and used as feedstock for the extrusion of composite filaments with Φ=1.75 mm in diameter. Through a complex investigation program launched for the identification and elimination of inefficient and incompatible modulated ratios for the bone reconstruction applications, the optimal technological parameters were delineated as follows: (i) the dispersion degree of all incorporated materials into the polymeric matrix, (ii) the influence of the reinforcement materials with/-out ATB on the surface features and on the overall mechanical behaviour of the composite filaments, in view of future 3D printing scaffolds with synergistic traits.

Selective references:

1. Ballard, D.H., et al., *Antibiotics in 3D-printed implants, instruments and materials: Benefits, challenges and future directions.* Journal of 3D printing in medicine, 3, 2, 2019, p. 83-93.
2. Mocanu, A.-C., et al., *Influence of Ceramic Particles Size and Ratio on Surface—Volume Features of the Naturally Derived HA-Reinforced Filaments for Biomedical Applications.* Journal of Functional Biomaterials, 13, 4, 2022, p. 199.
3. Mocanu, A.-C., et al., *Selection Route of Precursor Materials in 3D Printing Composite Filament Development for Biomedical Applications.* Materials, 16, 6, 2023, p. 2359.

Acknowledgements: "This work was supported by a grant from the National Program for Research of the National Association of Technical Universities - GNAC ARUT 2023".