



## Advanced Laser Synthesized Composite Coatings for Improved Bone Repair and Enhanced Antimicrobial Protection

Carmen Ristoscu<sup>1\*</sup>, Irina Ungureanu (Negut)<sup>1</sup>, Ion N. Mihailescu<sup>1</sup> and Gratiela Gradisteanu-Pircalabioru<sup>2</sup>

<sup>1</sup> National Institute for Laser, Plasma and Radiation Physics, 409 Atomistilor street, RO-077125, Magurele, Romania

<sup>2</sup> Research Institute of the University of Bucharest (ICUB), University of Bucharest, 050657 Bucharest, Romania

\*Corresponding author email: [carmen.ristoscu@inflpr.ro](mailto:carmen.ristoscu@inflpr.ro)

Osseointegrative and regenerative coatings represent attractive and tunable approaches towards enhanced biofunctions of metallic implants, providing a local modulation of the bone-to-implant interface. Bioactive glass coatings have proved to be beneficial layers for the modulation of bone cells' development, and further regeneration of the bone tissue.

Moreover, they have exhibited the ability to accelerate skin regeneration by enhancing angiogenesis and collagen deposition in the proliferation stage, as well as positive effects on all the other important stages of wound healing. They can adhere to hard tissues such as bone and aid in the regeneration of those tissues by forming a calcium-phosphate-like layer on their surfaces. The formation of this apatite layer results in a linkage between the hard tissue and the glass, which further leads to bone healing.

The incidence of opportunistic local infections and biofilm development on metallic implants can be prevented by surface modification with structures that act as a local biostatic or biocide. In addition to the osseointegration of implants, bioactive glass coatings can also function as depots for the adsorption and local release of antibiotics. Surface modification of metallic implants by bioactive glass coatings, obtained by laser processing, represents a suitable choice to easily integrate metallic implants and improve their overall biofunctionality. Our coatings hold promising perspectives for several targeted applications in the field of biomaterials, tissue engineering, and regenerative medicine [1-5].

**Acknowledgements:** This research was supported (or financed) by Romanian Ministry of Research, Innovation and Digitalization under Romanian National Nucleu Program LAPLAS VII – contract no. 30N/2023. IU(N) acknowledges a grant of the Ministry of Research, Innovation and Digital-ization, CCCDI – UEFISCDI, project number PN-IV-P2-2.1-TE-2023-0993 within PNCDI IV.

### References:

- [1] I. Negut, L. Floroian, C. Ristoscu, C.N. Mihailescu, J. C. Mirza Rosca, T. Tozar, M. Badea, V. Grumezescu, C. Hapenciu, I.N. Mihailescu; *Nanomaterials*, 10, 385 (2020)
- [2] I. Negut, C. Ristoscu, T. Tozar, M. Dinu, A.C. Parau, V. Grumezescu, C. Hapenciu, M. Popa, M.S. Stan, L. Marutescu, I.N. Mihailescu; *Pharmaceutics* 14, 1175 (2022)
- [3] Irina Negut, Carmen Ristoscu; *Applied Sciences*, 13, 6151 (2023)
- [4] I. Negut, G. Gradisteanu-Pircalabioru, M. Dinu, B. Bită, A.C. Parau, V. Grumezescu, C. Ristoscu, M.C. Chifiriuc ; *Biomedicines*, 11(10), 2772 (2023)
- [5] G. Grădișteanu-Pircălăbioru, I. Neaguț, M. Dinu, A.C. Pârâu, B. Bița, L. Duță, C. Ristoscu, B. Sava; *Biomedical Materials*, 20(1), 015019 (2025)