Laser fabricated coatings for biomedicine

Mihaela Filipescu
National Institute for Lasers, Plasma and Radiation Physics, 409 Atomistilor Steet, Magurele, Romania
Phone: 0040214574414
Email: mihaela.filipescu@inflpr.ro

Lead Author: Mihaela Filipescu
Co-Authors: Alexandra Palla Papavlu, Valentina Dinca, Anca Bonciu, Maria Dinescu

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Abstract

In the last decades, the biomaterials field is rapidly expanding and there are significant advances made in the technology of biomedical coatings and materials related to improved biological interaction between implant/device and host. The accent is put on combining the properties of various materials and methods to tune these characteristics in order to improve device performance. The materials processing with lasers gained more attention due to the wide large area of applications, starting with electronics up to biomedicine, as well to the possibility to tune materials and interfaces characteristics for the envisaged applications (i.e. bone or dental implants, drug delivery systems, meshes for surgery, etc.).

In this work, different types of organic and inorganic material coatings for biomedical applications processed as thin layers by different laser techniques (pulsed laser deposition and matrix assisted pulsed laser evaporation) are presented. Ceramics (i.e. ceria and zirconia) used for implants, various polymers (polyisobutylene, ethylcellulose, hydroxypropyl methylcellulose) for drug-delivery systems, or polymers composites (carbon nanotubes blended with poly-ethylene oxide and antibiotics) for meshes in surgery, are investigated.

By tailoring of deposition parameters (i.e. laser fluence, laser wavelength, gas pressure, temperature of the substrate) as well the methods chosen, the morphology and the structure of the above-mentioned coatings were adjusted for finding the optimal configurations for the specific biomedical applications. The wide range of coating types are discussed and their macro/microstructures, mechanical, physical and chemical properties are correlated with the cellular response.

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