

Modern 3D printing in biomedical engineering

Patrycja Szymczyk-Ziółkowska

Department of Laser Technology, Automation and Production Organization
Wrocław University of Science and Technology

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Abstract

Manufacturing of patient-specific bone implants that could integrate into the surrounding bone providing stable connection holds great promise for patients. Successful delivery of personalised orthopaedic implant depends on numerous factors. Material selection, fitted design with functional and mechanical properties, as well as technological aspects consideration, selection of innovative technology form the basis. Nevertheless, it is crucial not to forget about all the surrounding processes such as material preparation, process parameters optimisation, or post-processing treatments section, which should enhance the results even more. The conception and technical realisation of this complex task require an extensive knowledge gathering originating from various scientific areas such as engineering, material sciences, mechanics, chemistry, and physics supported with empirical and practical experience. Regeneration of large tissue defects caused by tumour resection or lost as a result of accidents is one of many challenges faced by surgeons. Individualised (custom-made) implants, shape-fitting patients' anatomies, are now easier to obtain thanks to modern computerised technologies, such as additive manufacturing (AM). Advanced 3D-printed implants eliminate the need for traditional treatments utilising autogenous transplants with additional surgery site or conventional implants and lower the risk of infections or implant loosening due to incomplete geometric adjustment.

About the presenter

Dr Patrycja Szymczyk-Ziółkowska is a specialist in the field of additive manufacturing and materials engineering. Since 2010 she has been working in the Department of Laser Technologies, Automation and Production Engineering, where she carries out research in the field of additively manufactured metal alloys, polymeric and hydrogel materials. Her main research areas are related to medical applications of AM technologies and includes the design and manufacturing of advanced biomedical objects, such as biomechanical functional structures for tissue regeneration, custom-made implants and smart drugs delivery systems for a wide spectrum of materials dedicated to the medical and pharmaceutical industry; microstructure and mechanical properties characterisation, both for AM-processed and conventionally manufactured materials; functional tests of final products. Dr Szymczyk-Ziółkowska is participating in numerous R&D projects and is co-author of scientific publications in the field of additive manufacturing technologies, microbiological and materials research.