

Meta-biomaterials: additive manufacturing of impossible biomaterials

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From invisibility cloaks to materials with negative stiffness, architected materials with properties that were once considered impossible are being currently developed by a wide range of researchers from different disciplines. Meta-biomaterials are a new addition to these novel classes of metamaterials, where otherwise impossible combinations of mechanical, mass transport, and biological properties are created through complex geometrical designs as well as complex spatial distributions of material properties at multiple scales starting from macroscale and going all the way down to nanoscale. This allows for incorporation of multiple favorable functionalities into one single piece of biomaterial including improved tissue regeneration performance and minimized risk of implant-associated infections. Progress in additive manufacturing (AM) techniques is at the center of these developments, as fabrication of meta-biomaterials requires application of multi-scale and multi-material AM techniques. This talk will introduce the concept of meta-biomaterials and will present an overview of the meta-biomaterials developed in my lab during the past decade.

100-word biography

Amir Zadpoor is Antoni van Leeuwenhoek Distinguished Professor, the Chaired Professor of Biomaterials & Tissue Biomechanics, and the founding director of the Additive Manufacturing Laboratory at Delft University of Technology. He specializes in development of advanced additive manufacturing techniques for fabrication of metamaterials with unprecedented properties. Moreover, he is a world recognized expert in origami- and kirigami-based (bio)materials that are made by combining shape-shifting with additive manufacturing. Prof. Zadpoor has received many awards including an ERC grant, a Vidi grant, a Veni grant, the Jean Leray award of the European Society of Biomaterials, and the Early Career Award of JMBBM.

