

PhD in Materials Science and Technology

Research Title: Biocompatible Materials for light induced 3D printing

Funded by	Politecnico di Torino (Joint Research Projects with Top Universities)
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Context of the research activity	<p>This research activity lays in the frame of the initiative “Joint projects to support research collaborations with excellent international organizations” ,funded in the frame of the multi-year Agreement 2016-2018 between Politecnico di Torino and Compagnia di San Paolo.</p> <p>So the PhD activity will be a collaboration project between Politecnico di Torino in Italy and ETH university in Zurich in Switzerland.</p> <p>3D printing (3DP) is a simple but extremely appealing process that allows building three-dimensional objects starting from a digital model. 3DP will surely be on the edge of innovation and technology in the next decades, influencing our lives on all the levels from large-scale production to everyday life. Among the different kinds of 3D printing apparatus for polymeric materials nowadays available, the class of machines exploiting light-induced polymerization (digital light processing DLP, stereolithography SL and two-photon polymerization 2PP) are extremely promising thanks to the fast production times and to the good resolution that they can achieve. Because of its versatility, 3DP will surely become a technique of fundamental importance in the biomedical field. In particular, the 3D printing apparatus exploiting light-induced polymerization could find their usefulness in several biomedical applications: from the production of devices with complex shapes for surgical applications (e.g. coronary stents), to the production of 3D shaped crosslinked hydrogel scaffolds for biomedical engineering studies, helping to build devices that can mimic the physiological environment (e.g. organ-on-chip).</p> <p>This project aims to develop printable biocompatible materials starting from the study of new PIs with reduced cytotoxicity effects. These PIs will be added to specifically designed formulations in order to obtain</p>
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	structures which could be employed as scaffold for cell growing, built with fast and cost effective stereolithographic technologies (e.g. DLP). The direct printing of cells laden formulations will also be pursued.
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Objectives	<p>The project will be performed between Politecnico di Torino and ETH in Zurich. The candidate will spend half of the period in both Universities. The project aims to study new formulations for the production of biocompatible 3D printed structures merging the expertise owned by the group at ETH laboratories and the one belonging to Politecnico di Torino. To develop biocompatible 3D objects, the following tasks will be pursued within the BioMa3D project.</p> <ul style="list-style-type: none"> - Synthesis of new photoinitiators - Study and optimization of 3D printable formulations with the choice of monomers that can assure the desired final properties (e.g. high swellability, good flexibility, mechanical stability...). - Study of the cytotoxicity of the formulations and of the cured polymers. - Study of the printing process of the developed formulations; evaluation of the properties of the 3D printable materials; modifications of the 3D printable formulations in order to gather good printability. - Design of a suitable biomedical device. - Study of the biocompatibility of the printed structures and modification of the formulations and printing parameters accordingly. <p>Since this PhD will be part of a Joint project, the PhD candidate will spend 18 months in Turin and 18 months in Zurich (not continuously).</p>
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Skills and competencies for the development of the activity	Good knowledge of chemistry and Polymer Science and technology. Knowledge on photopolymerization and good skills in laboratories for the synthesis of the new photoinitiators.
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