Exploring and exploiting two-photon polymerization for 3D Microfabrication

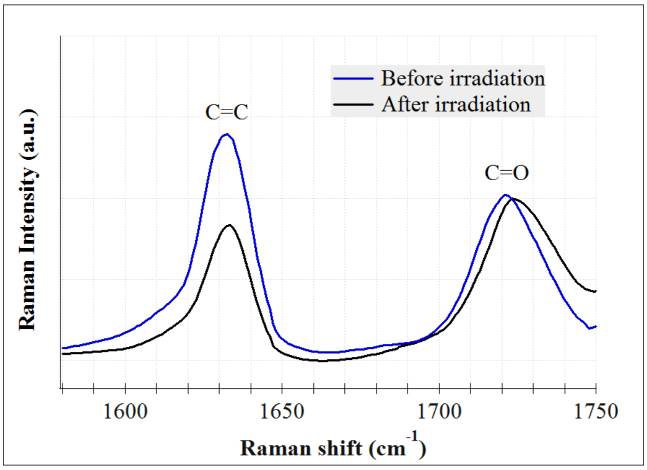
Jean-Pierre Malval[1], Laura Chia Gomez[1], Stephan Knopf[1], Olivier Soppera[1], Karine Mougin[1], Arnaud Spangenberg[1]

[1] Université de Haute-Alsace, CNRS, Institut de Science des Matériaux de Mulhouse, 15 rue Jean Starcky, F-68057 Mulhouse, France

E-mail: arnaud.spangenberg@uha.fr

Nowadays, there is a growing demand for compact and elaborate 3D microsystems to fullfill the requirements of emerging domains such as personalized medecine, point of care testing, microTAS to quote a few. Whereas different strategies have been successfully implemented for mass production of 2D/2.5D micro and nanostructures, fabrication of 3D micro and nanostructures is usually not trivial and required time-consuming multi-steps processes. In this context, additive manufacturing technology (AMT) is particularly attractive but suffers from a lack of spatial resolution. Thereby, two-photon stereolithography (TPS) appears of high interest since it makes possible in a unique step the fabrication of intricate 3D structures with features sizes as small as 100 nm[1].

However, since the first experimental demonstration of TPS in 1997[2], researches have been mainly focused on the design of photoinitiators[3-5] and the development of instrumentation (resolution, writing speed) [6]. But nowadays, one remaining challenge consists to develop and characterize a large choice of functional materials compatible with the TPS process[7]. To achieve this goal, the impact of the fabrication process on the geometric, chemical and mechanical properties of the resulting material has been investigated (Fig.1). These results aim to improve the understanding of the complex two-photon polymerized process and to facilitate the design of new advanced functional materials for TPS.



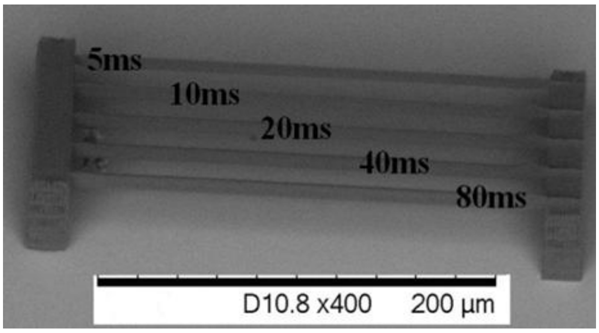


Figure 1. a) Raman spectra of the two-photon polymerized free-suspending microstructure and the nonpolymerized photoresist, b) Free-suspending 3D microstructures fabricated with distinct exposure time, and fixed power

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