O5

SUB-DIFFRACTION CONTROL OF THE HEIGHT AND FLUORESCENCE OF THE 3D STRUCTURES FABRICATED WITH DIRECT LASER WRITING (DLW) LITHOGRAPHY

G. de Miguel,[a,b] M. Duocastella,[a] G. Vicidomini,[a] A. Diaspro[a,c]
[a]*Istituto Italiano di Tecnologia, Genoa, Via Morego 30, 16163, Italy*
[b]*Departamento de Química-Física y Termodinámica Aplicada, Campus de Rabaneles, Ed. Marie Curie, Universidad de Córdoba, 14014, Córdoba, Spain*
[c]*University of Genoa, Genoa Via Dodecaneso 33, 16146, Italy*
q62mirog@uco.es

In the last few years, there have been many approaches to achieve the functionalization of the photopolymerized resins fabricated with the Direct Laser Writing (DLW) technique.[1] The sub-diffraction resolution together with the ability to create 3D structures render this technique very attractive to develop specific applications in the field of nanophotonics and biomedicine.[2] However, there is a lack of a general method to modify the physical and chemical properties of the photopolymerized resins. The classical strategy to functionalize the structures is to disperse the active material into the photoresist and then carry out the photopolymerization.[3]

In this talk, we report on a one-pot method to fabricate sub-diffraction structures through precise modification of the thickness of a photopolymerized resin. This approach takes advantage of the thermal effect provoked by the interaction between high peak-power femtosecond lasers and acrylic resins, resulting in a controlled expansion of the resin. The main characteristic of this method is the simplicity to fabricate the voxel, since in one simple writing process is possible to control the shape and height of the feature. In addition to the expansion of the resin, a parallel effect is observed in the doubly-irradiated areas: an enhanced fluorescence signal is detected in those areas. The selective functionalization of certain portions of the fabricated structures with a resolution in the nanometer scale is achieved, which opens the door to the development of next-generation nanomaterials with user-defined properties.

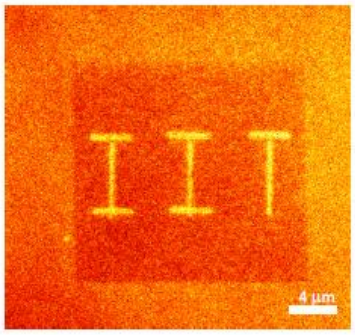

Figure 1. Confocal fluorescence image of a structure (square) fabricated with the DLW technique. The resin was selectively doped with a fluorescent dye, ATTO 565, to “write” the IIT logo through the a laser induced structuring technique.

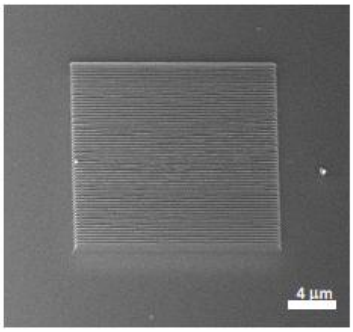

Figure 2. SEM image of the same fabricated structure as in Figure 1. No changes in the areas exposed to the second irradiation (IIT logo).

[1] Zhang, Y.-L.; Chen, Q.-D.; Xia, H.; Sun, H.-B. *Nano Today*, **2010**, *5*, 435.
[2] Harke, B.; Dallari, W.; Grancini, G.; Fazzi, D.; Brandi, F.; Petrozza, A.; Diaspro, A. *Adv. Mater.* **2013**, *25*, 904.
[3] Malinauskas, M.; Farsari, M.; Piskarskas, A.; Juodkazis, S. *Physics Reports* **2013**, 533, 1.