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Two-photon polymerization of photoresists for the application of artificial intelligence in 3D printing of photonic materials

Planar optical devices and fiber components (waveguides, Bragg mirrors, sensors, ⋯) have revolutionized the field of photonics. Usually, such components are fabricated using complex facilities similar to those used in the domain of silicon devices. With the development of direct laser writing methods (such as 2 Photon polymerization), it is now possible to print transparent 3D devices with a submicron resolution allowing to design novel functions or components that cannot be fabricated by usual means.

Home-made organic and hybrid resins (combination of monomers and silica precursors) or commercial ones are used as source of raw material for the printers. Once the optical component is 3D printed (the resin is locally photopolymerized where the laser is focused), some additional treatments are needed to obtain the transparent material or function (washing for removing uncured resin, heating to remove the organic part, ⋯). This project is a part of PhotonIA project, which aim to build artificial intelligence models capable of predicting, for each specifically targeted optical function, the adapted manufacturing protocol.

During this internship, you will contribute to this research field by printing and characterizing some simple objects (boxes, lens, 1D photonic bandgap components, ⋯). Optical characterization that are envisaged are for example: the refractive index, the Rayleigh scattering coefficient, ⋯ Measurements are however challenging since dimensions are in the order of 200 x 200 x 200 µm. Some available characterization benches will be adapted in this internship.

The internship will take place within the Photonics team of the PhLAM laboratory, located in the IRCICA Institute and is related to activities developed within the framework of Equipex+ project (ADD4P) and PhotonIA project (PEPR DIADEM). This intership is funded by the PEPR DIADEM.

Keywords: