ACRYLIC RESINS FOR LASER 3D LITHOGRAPHY OF HIGHLY-POROUS MICROSTRUCTURES

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Inertial Confinement Fusion (ICF) is a potential way to produce energy by using high-power lasers to compress a fuel capsule. Low-density foams find common use as targets in experiments involving laser-plasma interactions because they can be converted into large-volume homogeneous plasmas. The major advantage of utilizing foam targets lies in their swift transition from a structured solid material to a nearly uniform plasma under intense radiation [1]. To produce such low-density foams lithography techniques are used. Particularly in this experiment, two photon polymerization that provides significant advantage in print resolution in creating three-dimensional microstructures [2].

In this research, our task is to create foams comprising exclusively of light elements for example hydrogen, carbon, and oxygen. For this purpose, we employ acrylic resins. Highly-porous microstructures play a crucial role in ICF, because they serve multiple functions, such as smooth the laser beam inhomogeneities, enhance the laser absorption as well as increase the ablation loading in a layered target configuration. However, a problem arises when using foams which contain only light elements as they tend to shrink during the two-photon polymerization process and structure development. Therefore extensive and varied research is necessary to identify the most suitable resin for low-density foams. This study focuses on investigating the optimal acrylic resin and photoinitiator for the development of low-density highly-porous microstructures, intended for application in ICF.

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