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Microfluidic-based foams: a possible template for photonic structures[1] ILHAM MAIMOUNI, MARIA RUSSO, MARYAM MORVARIDI, JANINE COSSY, PATRICK TABELING, Ecole Suprieure de Physique et de Chimie Industrielles, PSL, France — Through the past decades, foams have taken more and more place into our modern world and have been used in a myriad of applications such as insulation building materials, food industry and photo-catalysis thanks to their interesting structural properties. Recently, 2D foams have been investigated to be self-assembled materials exhibiting interesting photonic properties. In the present study, we aim at exploring the 3D foams case. In this perspective, microfluidic technologies are used to develop 3D, solid, highly monodisperse polymeric foams by packing air bubbles in aqueous solution containing a polymer. The bubbles are produced in a PDMS (Polydimethylsiloxane) microfluidic chip and directly assembled in a microfluidic channel giving birth to highly tunable 3D foam. Indeed, by varying fluid pressures, the foam composition and the polymerization process, we manage to sharply control bubbles production and thereby govern the structural properties of the obtained material: porosity, pores size, connectivity and polydispersity. Electromagnetic simulations are then performed to study wave propagation in such foams, revealing very interesting transmission regimes and opening the way for a new technological application of fluid-based systems.

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