Photolithographic fabrication of solid–liquid core waveguides by thiol-ene chemistry

In this work we demonstrate an efficient and cleanroom compatible method for the fabrication of solid–liquid core waveguides based on nanoporous polymers. We have used thiol-ene photo-grafting to tune and pattern the hydrophilicity of an originally hydrophobic nanoporous 1, 2-polybutadiene. The generated refractive index contrast between the patterned water-filled volume and the surrounding empty hydrophobic porous polymer allows for light confinement within the water-filled volume—the solid–liquid core. The presented fabrication process is simple and fast. It allows a high degree of flexibility on the type and grade of surface chemistry imparted to the large nanoporous area depending upon the application. The fabrication does not need demanding chemical reaction conditions. Thus, it can be readily used on a standard silicon lithography bench. The propagation loss values reported in this work are comparable with literature values for state-of-the-art liquid-core waveguide devices. The demonstrated waveguide function added to the nanoporous polymer with a very high internal surface area makes the system interesting for many applications in different areas, such as diagnostics and bio-chemical sensing.

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