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Bio-inspired soft nanofluidic networks created and controlled by light NAVAL SINGH, Department of Chemical Engineering, Loughborough University, ARWEN TYLER, School of Food Science and Nutrition, University of Leeds, GUIDO BOLOGNESI, Department of Chemical Engineering, Loughborough University, ANDREW WARD, Central Laser Facility, STFC, COLIN BAIN, Department of Chemistry, Durham University, YUVAL ELANI, OSCAR CES, Department of Chemistry, Imperial College London — The manufacturing of soft fluidic structures, based on multiple micron-sized compartments interconnected by lipid-stabilised or surfactant-stabilised nanoconduits, are attracting an increasing level of attention. These soft constructs have shown a great potential as minimal cells in synthetic biology, simplified model systems for biophysical and biochemical studies and smart containers for drug delivery and microreactor technologies. However, the creation of such nanofluidic networks can be a relatively difficult task. A well-known fabrication protocol is based on the micro-manipulation of polydisperse giant unilamellar vesicles (GUVs), leading to the creation of lipid nanotubes and daughter vesicles. Here, we present new approaches for the rapid generation of nanofluidic networks based on the optical manipulation of soft structures and particles at liquid interfaces, including i) surfactant-coated ultralow tension droplets and ii) adhesive GUVs. These contactless approaches offer several advantages, including easy implementation, fast (few mins) fabrication of arbitrary complex 2D/3D networks, fine control over network geometry parameters and ability to connect chemically distinct reservoirs (from fL to nL in volume) across distances from 1 μm to 100s of μm.

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