3D printing of oil-in-water emulsions for conductive objects

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Three dimensional (3D) printing is highly efficient tool that enables the formation of complex structures that was impossible to fabricate with traditional processes. Additive manufacturing, or three dimensional printing, is implemented in a variety of fields such as rapid prototyping and scaffolds for medical applications. The 3D structures are formed with various monomers or polymeric precursors and additives, while currently the main functionality of the structure is defined by its monomer.
The goal of our research is to fabricate 3D porous structures containing continuous functional matrix within the pores. These structures are fabricated by printing a newly developed oil-in-water emulsion ink composed of curable acrylic monomers mixture as the "oil" droplets, dispersed in an aqueous phase. The printing is performed by the digital light process (DLP) method, in which the structure is formed by localized polymerization of monomers. At the first stage, the UV light initiates curing of the monomer droplets, while at the second stage, the continuous water phase evaporates and interconnected voids are formed. Currently we focus on impregnating the voids within the printed objects with silver nanoparticles that after a simple room temperature sintering process form a conductive, continues silver matrix within a solid polymer.

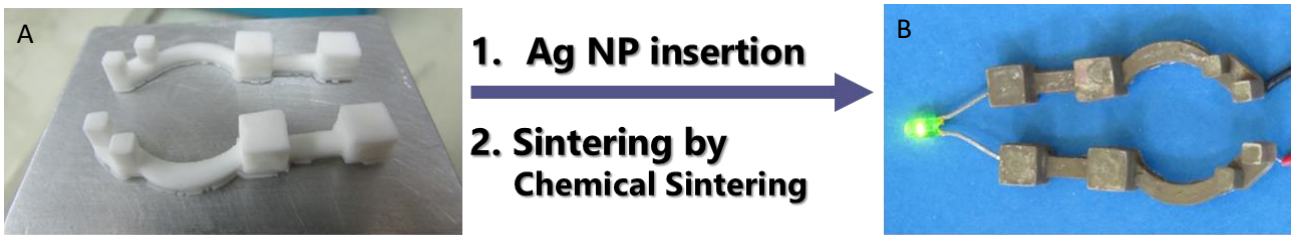

Figure 1 Scheme of the process for fabricating a conductive structure. (A) Images of an electric circuit printed from the curable emulsion (B) Image of the porous structure after inserting Ag in DB dispersion, sintering and connecting to 1.5V and LED.

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[1] I. Cooperstein, M. Layani and S. Magdassi, J. Mater. Chem. C, 2015, **3**, 2040.
[2] M. Layani, I. Cooperstein and S. Magdassi, J. Mater. Chem. C, 2013, **1**, 3244.