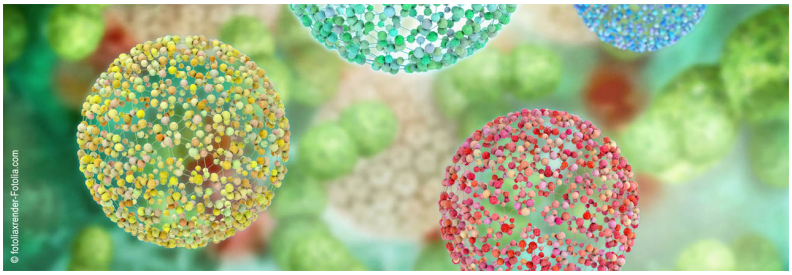


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# 4D printing of a magnetic and plasmonic object by DLP

In the last decades, 3D printing has emerged as a powerful technique to create personalized objects and is now considered as a leading technology in numerous sectors of industry*1*. Using this solid basis, 4D printing was more recently introduced. Here smart (composite) materials are used to print functional objects with on demand properties. In this way, custom-made time-programmable properties are added to static 3D printed structures*2*.

This new concept, still at its infancy, is currently mostly used to create unifunctional objects, which means elements possessing a single response to external stimuli. In this project, we aim at developing 4D printed multifunctional objects based on the combination of a functional matrix embedding multi-elemental fillers, i.e. magnetic and plasmonic micro and nanostructures. The objective is to obtain designed magneto-plasmonic active elements.

First, a scale-up synthesis of raspberry like magneto-plasmonic particles was developed and particles were obtained by functionalizing magnetite particles with gold nanoparticles, giving 500 mg of particles per synthesis. A substantial save of time was obtained compared to classical synthesis*3*, enabling the synthesis of a sufficient quantity of particles for incorporation in a resin.

Second, we investigated the incorporation into a photopolymerizable resin for 3D printing by DLP. The choice of a formulation for the resin is also investigated to optimize the incorporation of these particles, and optimize its rheology to obtain a shape-changing or moving object with magnetism. The printing of small objects was then achieved, with a resin charged at 2% of mass.

The first developments of our project are promising and may lead to a proof of concept of a 3D printed object with time-dependant magnetic and plasmonic response, contributing to enrich the possibilities of 4D printing.

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