Synthesis of metallic colloidal suspensions of controlled size and morphology for the fabrication of 3D composite objects

Quentin Bauerlin[1], Xingyu Wu[1], Benjamin Leuschel[1], Damien Favier[2], Christian Gauthier[2], Thierry Roland[2], Karine Mougin[1], Arnaud Spangenberg[1]

[1] *UMR 7361 CNRS-Université de Haute Alsace, Institut de Science des Matériaux de Mulhouse, 68057 Mulhouse, France.*
[2] *UPR22 CNRS, Institut Charles Sadron, 67034 Strasbourg, France.*

E-mail: quentin.bauerlin@uha.fr

3D printing is currently at the heart of various industrial challenges with the manufacture, production and study of new complex products. However, this technology still suffers from certain limitations, particularly in terms of choice of materials. This project therefore focuses on the implementation of 3D printing processes to manufacture complex three-dimensional objects capable of reacting or adapting to their environment, a process known as 4D printing. To achieve this objective, new resins for additive manufacturing by photopolymerisation are being developed. Different objects with controlled geometry according to the type of 4D effect studied are produced by photopolymerisation and respond to different stimuli such as temperature, light, etc [1]. In this context, colloidal suspensions in different forms (spherical, rod, etc.) are elaborated and introduced into photosensitive resins [2]. Indeed, the particles have several properties and the composites add new properties to materials [3]. Several stimuli (light, humidity, etc.) have been explored and have made it possible to highlight new modes of actuation or new properties. These new programmable materials open perspectives in many applications such as the simplified integration of sensors in macroscopic 3D objects [4].

References:
[1] Ge, Qi, A. H. Sakhaei, H. Lee, C. K. Dunn, *Scientific Repo. 2016,* 6, n° 1: 31110.
[2] X. Ye, C. Zheng, J. Chen, Y. Gao, CB, Murray, *Nano Lett.* **2013**, 13, 765-771.
[3] Zhang, Zhiyang, H. Wang, Z. Chen, *Biosensors and Bioel.* **2018**, 52-65.
[4] X. Han, Y. Liu, Y. Yin, *Nano Lett.* **2014**, 14, 2466−2470.