DEVELOPMENT OF COMPOSITE PHOTORESISTS FOR 3D AND 4D PRINTING

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The use of 3D/4D printing to create new composites is diversifying applications in fields such as robotics, medicine, etc. The design of this type of material in 3D printing is still limited and does not result in high quality objects[1,2]. In this communication, we introduce a simple route to fabricate composite materials exhibiting dual stimuli. Special attention has been paid to the design of 4D composite in order to bring a fine control to the reversible shape deformation. One of the key parameters lies in the insertion of metallic gold nanoparticles into hydrogel object to confer it a 4D feature[3-4]. Firstly, a description of the synthesis of the nanoparticles followed by the analysis of the morphology/size/dispersion by UV-vis spectrum and TEM imaging are performed. Different concentrations of nanoparticles were used, with the aim of observing its impact on the photoreactivity/viscosity of the formulations and their printability. Resolution and fidelity criteria regarding the CAD model were assessed by investigating printed objects by SEM microscopy. Finally, camera tracking combined with different mathematical models are used to understand the swelling and thermal properties of these objects. By playing with the light intensity or the nanoparticles concentration, the increase of temperature can be controlled in a precise manner leading to the production of a 3D object that responds to a dual stimuli: moisture for swelling and heat for returning the printed object to its initial size (Figure). By taking advantage of the synergy between these dual properties, progress to various fields such as soft robotics can be envisioned.

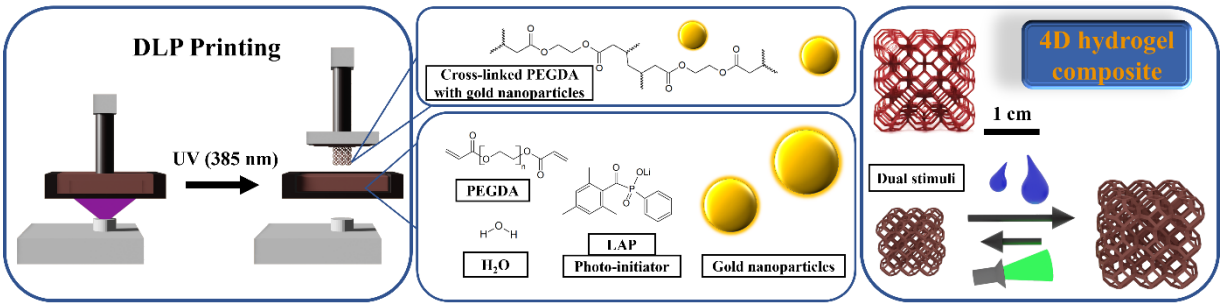

Figure : Global outline of the subject

References

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3. X. Xu, S. Ozden, N. Bizmark, C. B. Arnold, S. S. Datta & al., A Bioinspired Elastic Hydrogel for Solar‐Driven Water Purification, Advanced Materials, 2007833, 2021.
4. Q. Bauerlin, X. Wu, L. Josien, K. Mougin, D. Favier, C. Gauthier, T. Roland, A. Spangenberg, 4D hydrogel composite with complementary dual stimuli manufactured by DLP, submitted.