Thionolactone as Resin Additive to Prepare (bio)degradable 3D Objects via VAT Photopolymerization

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ABSTRACT:

3D printing and especially VAT photopolymerization leads to cross-linked materials with high thermal, chemical and mechanical properties. Nevertheless, such stability is incompatible with degradability and re/upcyclability. We showed here that thionolactone and especially dibenzo[c,e]-oxepane-5-thione (DOT) could be used as an additive (2 wt%) to acrylate-based resins to introduce weak bonds into the network via a radical ring-opening polymerization process. The low amount of additive allows to only slightly modify the printability of the resin, keep intact its resolution and maintain the mechanical properties of the 3D object. The resin with additive was used in UV microfabrication and 2-photon stereolithography setup and commercial 3D printers. The fabricated objects were shown to degrade in basic solvent as well in a home-made compost. The rate of degradation is nonetheless dependent of the size of the object. This feature was used to prepare 3D objects with support structures that could be easily solubilized.

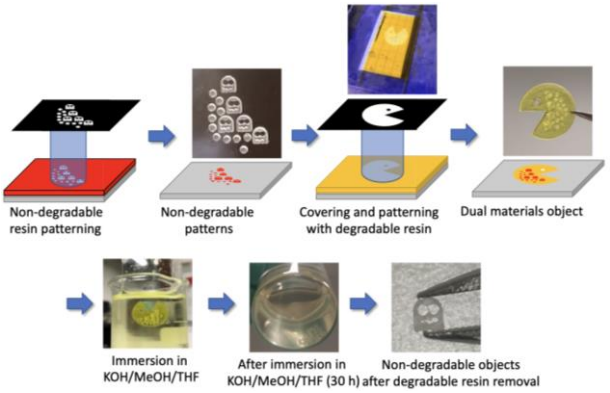

Figure 1 : Embedding a non-degradable object in the degradable resin: example of a degradable Pacman head containing ghosts and balls that are non-degradable.

Reference

1- N. Gil, C. Thomas, R. Mhanna, J. Mauriello, R. Maury, B. Leuschel, J.-P. Malval, J.-L. Clément, D. Gigmes, C. Lefay, O. Soppera, Y. Guillaneuf, Angew. Chem. Int. Ed. 2022, e202117700. https://doi.org/10.1002/anie.202117700