WAVELENGTH ORTHOGONAL PHOTOCHEMISTRY IN ADDITIVE MANUFACTURING: TOWARDS PHOTOPOLYMERS WITH TAILORED PROPERTIES

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Abstract

Orthogonal photoreactions have gained increased attention in polymer chemistry over the last decade.[1] The selective activation of chromophores with light of different wavelengths enables the spatial and temporal control of the material properties in lithography based additive manufacturing.[2,3,4]
In this contribution, several photo crosslinkable groups were investigated and introduced in thiol-ene reactive systems. The sequence-dependent λ-orthogonality of network formation and crosslinking reaction allows for the spatially resolved alteration of thermo-mechanical properties during or after 3d printing.
Furthermore, the selective activation of bond exchange reactions in photopolymers by sequence-dependent λ-orthogonality was studied.[5] Therefore, a temperature-resistant (> 200 °C) organic phosphate with a photolabile o-nitrobenzyl protecting group was introduced into a visible light-curable thiol-ene resin. Once cured, irradiation at 372 nm spatiotemporally activates the phosphate, which catalyzes transesterifications at elevated temperature. The formed catalyst has no effect on the thermal stability of the polymeric network and allows the activation of bond exchange reactions in selected domains of printed 3D objects.
The use of sequence-dependent λ-orthogonality easily enhances the versatility of lithography-based additive manufacturing and is an important step towards establishing this technology in our daily lives.

References

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