Revolutionary Sn-based photoinitiators: how to combine long wavelengths with reactivity and stability

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Photopolymerization finds applications in a wide variety of fields, such as coatings,[1] 3D printing,[2] dental materials[3] and many more.[4] The limitation of the thickness of the curable layers is the wavelength of the used light, as light with longer wavelengths can penetrate deeper into materials than light with shorter wavelengths.[5]

Therefore, photoinitiators (PI) with red-shifted absorbance are favourable as they enable the use of light with longer wavelengths and therefore higher curing depths. This can be achieved for instance by the introduction of heteroatoms as central atom, typically P or Ge. Generally, the bathochromic shift is higher the bigger the central atom is, as can be seen for stannanes compared to Ge-based PIs.[6]

In our work, we synthesized a novel tetraacylstannane with absorbance up to 560 nm, about 70 nm longer than the commercial state-of-the-art PI. Reactivity and photobleaching behaviour were also tested and resulted in outstanding properties at 460 nm compared to three reference compounds. One of the most crucial parameters is the stability, as so far, no literature-known Sn-based PI is stable enough in formulations to make it into industrial application. With our novel tetraacylstannane, we found the first Sn-based PI that is as stable as the current state-of-the-art Ge-based PI and hence fulfills all criteria for industrial photopolymerization processes.

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