Sub-diffractional optical lithography of π-conjugated polymers

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Stimulated emission depletion (STED) proved to break the diffraction limit of resolution in fluorescence microscopy. Besides, it was proposed already in 1999 that the STED-confined excitation volume should be applicable to spatially control photochemical reactions on the nanometre scale.[1] Meanwhile, this prediction has been experimentally realized using two-photon induced radical polymerization of negative tone resists, most of them (meth)acrylates.[2-4] Progress has been made in finding an optically depletable starter which shows only low autofluorescence in the visible spectrum, so that it can be used to construct scaffolds for biomedical applications which do not optically interfere with fluorescent tags.[5] Lately, we succeeded to transfer this concept to cationic polymerization of epoxides.[6]

Most recently, we are now applying STED-inspired two-photon lithography to π-conjugated polymers.[7] We found photoinitiators for oxidative polymerization of EDOT (3,4-Ethylenedioxythiophene) that are excitable with two photons of 780 nm light and depletable with 660 nm. Sub-100 nm lines were successfully written. Our results bear potential for prototyping sub-100 nm organic electronic devices.

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