SUB-DIFFRACTION OPTICAL LITHOGRAPHY BASED ON A CW STED SETUP WITH TWO-PHOTON EXCITATION

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Keywords: Two-Photon-Lithography, Nanoscopy, Sub-diffraction writing

ABSTRACT

Optical writing via multi photon processes has been of major interest in the last years since its capability of writing in all spatial directions with high resolution opening new fields of application [1,2,3]. Usually, a photo initiator is excited by the absorbance of one or two photon and generates free radicals causing polymerization of the monomer in a confined volume. Unfortunately, the smallest achievable feature size is still limited to the diffraction limited size of the area of excited photo initiator molecules.

In this work, we present a way to overcome this diffraction barrier based on the RESOLFT (reversible switchable optical transitions) concept that has already been verified for fluorescence imaging techniques [4] in which the diffraction limit governs its resolution. In order to perform sub-diffraction lithography, a controlled way to transfer the excited photo initiator molecules to an inactive state has to be discovered [5]. Temporally, this transfer mechanism has to take place before the photo initiator can cause polymerization of the resin. Spatially, the transfer beam has to be shaped featuring a zero of intensity in its center.

The optical setup used is based on a custom made STED (stimulated emission depletion) microscope with one or two photon excitation and a STED beam generated by a high power CW laser. For the characterization of the optical setup, sub-diffraction resolution fluorescence images by STED microscopy will be presented. Thereby, the thematic connection between STED microscopy and sub-diffraction lithography will be discussed and the first results for sub-diffraction lithography will be shown.

REFERENCES