OPTICAL SECTIONING IN A SINGLE EXPOSURE USING POLARISATION-CODED STRUCTURED ILLUMINATION MICROSCOPY (picoSIM) AND NANOGRATINGS

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ABSTRACT

Conventional wide-field microscopy, though a great tool in biological as well as material imaging, is significantly restricted in performance when dealing with thick samples. Out-of-focus and in-focus features are illuminated uniformly, causing blurred images with low signal to noise ratio. Optical sectioning methods like structured illumination microscopy (SIM) [1] aim to eliminate these out-of-focus contributions and exclusively retain the focal plane information. However, the need to acquire at least three images for each sample slice in classical SIM proves to be a limiting factor for speed.

Polarization-coded structured illumination microscopy (picoSIM) [2] is a modified version of SIM that performs optical sectioning in a single exposure, yielding high temporal and spatial resolution. In this poster, we propose a novel design for a picoSIM system based on a special nanograting [3]. The polarization-coded pattern with a uniform intensity distribution with linearly varying polarization needed for picoSIM is produced by the nanograting, thus significantly optimizing the setup. Moreover, it enables the use of incoherent light and extends the applications of picoSIM to material microscopy. Optically sectioned images of a ceramic chip (Fig.1) with a few milliseconds exposure times demonstrate the capability of the technique.

Figure 1. (a) Widefield image of a ceramic chip showing focussed as well as blurry regions. (b) Optically sectioned image of a ceramic chip with reduced the out-of-focus.

References: