OPTICAL COHERENCE TOMOGRAPHY IMAGING THROUGH THE SCALES

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Since its roots in the 1990s Optical Coherence Tomography (OCT) has gained a continuous improvement and found a successful entrance in different medical subject fields, as non-invasive imaging tool for supporting diagnostics. For medical imaging a spectral range of 800-900 nm is often exploited as a preferred region. Later, the field of non-destructive testing (NDT) came up as a novel application for OCT imaging, where, a spectral range between 900-1500 nm became of interest, especially for the probing of different polymer and composite materials [1]. For art inspection a region to the 1500-2000 nm has proven beneficially [2].

Due to the upcoming of supercontinuum (SC) light sources, emitting spectrally broad-band in the near- and mid- infrared (NIR/ MIR) range, the MIR spectral window between 2-5 µm, beyond the NIR, became also accessible for OCT imaging. Recently we have developed a MIR Fourier Domain (FD)-OCT system operating in the 3-5 µm spectral range [3]. Now we demonstrate a NIR/MIR SC based solution for an advanced OCT, which allows to tune the spectral range for the specimen under investigation. Mirror optics and numerical aberration correction enable to cope with the extreme broadband spectral range. On the side of detection we apply a pyroelectric line array as cost-effective (compared with semiconductor based infrared cameras) solution, combined with a dedicated control and signal processing. This advanced and flexible FD-OCT modality allows NDT which is applicable e.g. for dimensional measurements and quality inspections of ceramics, porcelain and highly scattering polymer materials, as well as for dental teeth prosthetics or art inspection. We will highlight our recent developments and show our latest results of the flexible NIR/MIR FD-OCT imaging here.

Figure 1: OCT cross-sectional views of (left) coating with fine details in porcelain material in the NIR region and (right) embedded laser-machined microchannels in ceramic layers recorded by the MIR FD-OCT.

References:

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