3D COHERENCE MICROSCOPIC IMAGING BY FULL FIELD OPTICAL COHERENCE MICROSCOPY AND IN-LINE HOLOGRAPHIC MICROSCOPY

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The basic optical scheme for full field optical coherence microscopy (ffOCM) is the Michelson interferometer. It works in reflection mode. Interference images can be taken from different depths of the sample by tuning the interference with a reference mirror. A low coherent illumination is used to select different z-positions of a 3D-volume in the range of λ/2. It is shown how the degree of coherence corresponds inversely with the z-resolution.

Starting from the basic scheme of ffOCM, as shown Figure 1, by subsequently modifying individual components, such as illumination and detection, as depicted in Figure 2, or the reference path, the idea of a new compact setup of an in-line/common-path ffOCM is derived. In the special case, without scanning of the reference mirror – but with a fixed mirror – the setup is known as digital in-line holographic microscope (DIHM). In this case coherent light is to be used. The transition between both (low) coherent microscopy techniques [1, 2], operating in transmission and/or reflection regime, will be illustrated and gives potential for a miniaturized and hybrid design.

For both arrangements the imaging of diverse micro-particles and rather continuous structures is presented and compared, Figure 3. Furthermore, the single-shot ability of both techniques will be discussed with the background of micro-fluidics applications.

Figure 1: Scheme of conventional full field optical coherence microscopy (ffOCM), (D: detector, M: mirror, L: light source, S: sample).

Figure 2: Scheme of modified ffOCM using an imaging detector with a pinhole (DP) and a light source, partly as in-line arrangement.

Figure 3: Image sub-sections: (a) en-face ffOCM image, recorded in reflection mode; (b) DIHM image, recorded in transmission regime; (c) DIHM image, recorded in reflection regime. The different imaging techniques have been exemplified (a, b) for micro-particles in similar micro-fluidic surroundings, or (c) for a particle-water suspension applied as a thin film; the drying film boundary is seen in (c). (Contrast enhanced; image area about 200 x 200 µm²).