

The mesoscale of biofilms

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Imaging of biofilm systems is a prerequisite for a better understanding of both structure and its function. The presentation will give a very short overview on common and established imaging techniques for biofilms such as scanning electron microscopy (SEM), confocal laser scanning microscopy (CLSM), Raman microscopy (RM), magnetic resonance imaging (MRI), and optical coherence tomography (OCT). The latter provides exceptional imaging capabilities paving the way to the mesoscale of biofilms. The mesoscale has been proposed to cover several mm large biofilm structures. It was further suggested that the mesoscale provides a representative view since it contains repeating structural units. In biofilm research typically a special focus is paid to the micro- and mesoscale, because mass transport and transfer processes as well as fluid-structure interactions are occurring at these scales.

The mesoscale most suitable investigated by means of OCT. Principle, resolution, imaging velocity, and limitations of OCT are thus presented and discussed in the context of biofilm applications. Examples are provided showing the strength of this technique with respect to the visualization of the mesoscopic biofilm structure as well as the estimation of flow profiles and shear rates. Finally, the implementation of multi-dimensional OCT datasets in biofilm modeling is shown aiming on an improved understanding of mass transfer at the bulk-biofilm interface and the mechanical characteristics of biofilms.