Brewster Angle microscopy

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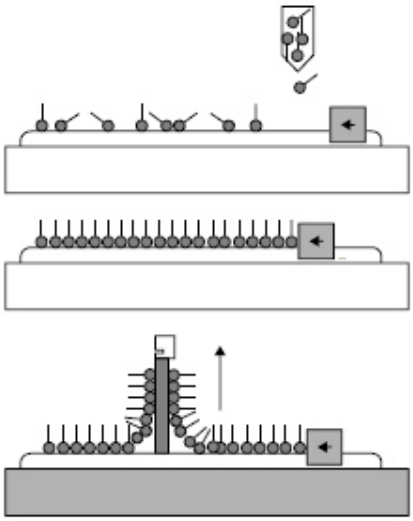
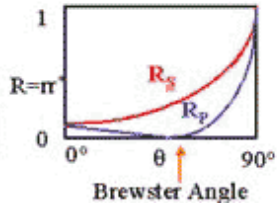
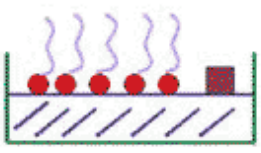
Monolayer at the air-water interface are interesting quasi-two-dimensional model systems for studying fundamental interactions. They are also a precursor film within the LB fabrication process as illustrated in the following figure:

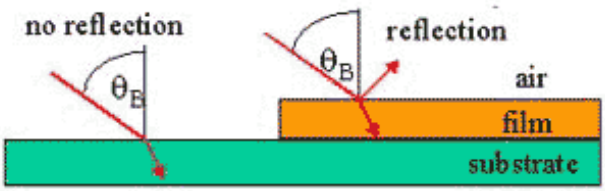


The amphiphile is dissolved in an organic solvent and subsequently spread at the air-water interface. The solvent evaporates and a monolayer of the amphiphile at the air-water interface is then produced. These so called Langmuir monolayers can be further manipulated by means of a moveable barrier which allows us to control the area per molecule. They possess a large number of phases which may exhibit a different orientation, tilt azimuth or rotational degrees of freedom of the molecules. These features can be visualized by means of Brewster Angle Microscopy (BAM). The typical domain sizes are in the order of 20-200 micrometers.

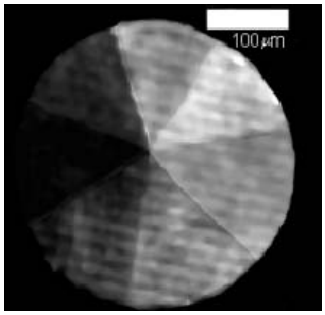
The existence of a Brewster angle is a peculiarity of p-polarized light. The reflectivity coefficient r_p vanishes at the Brewster angle and hence no light is reflected there. A monolayer at the air-water interface yields a certain amount of reflected light $r_p = 10^{-6}$, which is sufficient to produce an image. This technique is superior to fluorescence microscopy, since it does not require any label which could have an undesired impact on the systems.

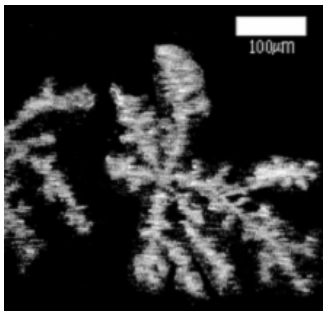


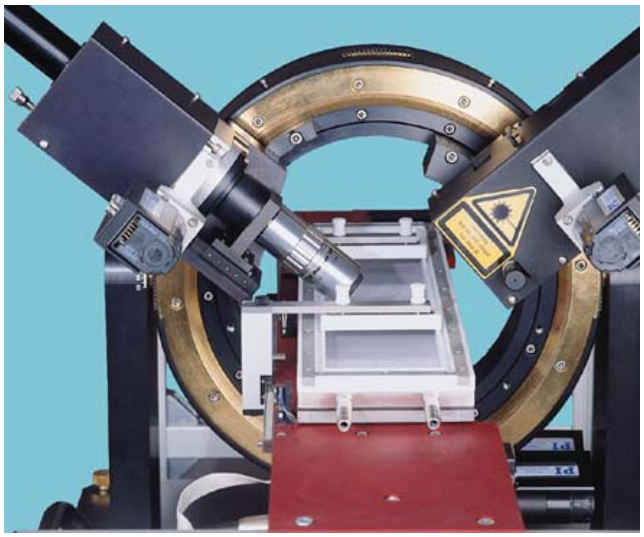




The following example shows the BAM image of domains of the glycerol ESD-16 recorded at the air-water interface. The domains are of circular shape and possess a sevenfold internal symmetry. The contrast between the segments is due to the different organization of the tilt azimuth within each segment. The picture on the right hand side shows the same domains at the oil-water interface. The circular shape is lost due to a reduction of the line tension. (M. Harke, H. Motschmann, "On the Transition State between the Oil-Water and Air-Water Interfaces", Langmuir, 14, 313 (1998))







Optrel GbR has established a successful collaboration with the company Riegler&Kirstein ltd. (www.rieglerkirstein.de). The result is a custom made trough for the Multiskop which is displayed in this figure.