

## 4.7 Construction of a Scanning Force Microscope for the Inspection of Liquid/gas Interfaces

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Within this project, we developed a scanning force microscope (SFM) for the inspection of the liquid/gas interface as it occurs on floating Langmuir films. The compact and rigid design allows the in-situ inspection of the LB chromophores which can be synthesised to have specific optical properties (i.e. frequency doubling abilities, etc.).

In order to accomplish chromophore inspection from the water-side, the SFM is water-tight. It is based on a stand-alone principle that can be incorporated into an existing LB trough upside-down. Fittings and seals were all machined from Teflon to maintain good hydrophobic properties necessary for LB film inspection and deposition.

Since any vibrations may cause the water subphase to oscillate the microscope was constructed for complete remote-control. This specifically includes two mirror stages with which the laser beam can be focused onto the SFM cantilever and the 4-quadrant detector, respectively. Also, coarse and fine approach can be controlled remotely by using DC-motors.

The mirror stages of approximately 1 cm<sup>3</sup> in size consist of a mirror plate that is glued to a steel sphere which can be rotated according to the principle of inertial stick-slip motion. Here, shear piezos transform a saw-tooth wave-form into a similar displacement causing the mirror to tilt step-wise. A special electronic control unit has been developed to accurately control laser adjustment with these mirror stages down to a resolution of 10<sup>-6</sup> rad.