The Structure and Function of Pulmonary Surfactant. Atomic force microscopy and Kelvin Probe Force Microscopy Study

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Molecular arrangement of lipid films gives rise to an electrical surface potential, which rules many biological processes in lipid membranes and monolayers. Molecular films of pulmonary surfactant (PS) cover lung epithelia to provide stability to the alveolar structure and reduce work of breathing. PS are composed of mixed lipid monolayers and surfactant specific proteins. The surface potential of pulmonary surfactant films is defined as the difference in electrical potential between the film surface and aqueous lining of the lung and is important for PS functioning in the lung.

In this work Atomic force microscopy (AFM) and Kelvin-probe force microscopy (KPFM) was used to investigate the topography, adhesion and locally variable surface potential of pulmonary surfactant films. KPFM is derived from AFM where a minute probe records the local electrostatic interaction through electrostatic influence charges. AFM based force measurements were performed to address the physical properties of the surfactant film. Data on AFM topography, local surface potential distribution, and force measurements correlate well and provide more insight into the understanding of the molecular function of pulmonary surfactant. Effects of surface compression and the presence of cholesterol on the monolayer structure and surface potential distribution will be reported.