Conformation and interfacial properties of protein adsorption layers

R. Wüstneck1*, V.B. Fainerman2, E.V. Aksenenko3, Cs. Kotsmar4, V. Pradines5, J. Krägel1 and R. Miller1

1 Max Planck Institute of Colloids and Interfaces, 14424 Potsdam/Golm, Germany
2 Donetsk Medical University, 83003 Donetsk, Ukraine
3 Institute of Colloid Chemistry and Chemistry of Water, 03680 Kiev, Ukraine
4 University of California at Berkeley, Berkeley, CA 94720-1462, USA
5 Laboratoire de Chimie de Coordination, 31077 Toulouse cedex 04, France

The starting point of investigating interfacial properties of protein adsorption layers are usually interfacial tension isotherms, $\gamma(c)$, and dynamic interfacial tension measurements, $\gamma(t)$. These values however conceal information about conformational changes and interfacial rheological properties of the adsorption layers, which are not sufficiently well expressed by $\gamma(c)$ and $\gamma(t)$. A comprehensive thermodynamic modeling of the interfacial behavior of protein adsorption layers can therefore not be focused exclusively on these values, but should include simultaneously consider the complex interfacial dilational elasticity and viscosity properties.

In recent years we developed a thermodynamically model which was successfully employed by different groups to describe the interfacial properties of protein layers and even their mixtures with surfactant molecules. In describing the flexible protein ß-casein it however fails sometimes, which shows that the model needs further improvement and refinements. Using a special type of modified $\gamma(t)$ measurements combined with interfacial area oscillation technique the state of the art in modeling will be demonstrated to include the range of long time adsorption, i.e. including questions of adsorption layer aging, multilayer formation ect. at different pH and interfaces. The experimental results clearly show a behavior which cannot be reflected by $\gamma(t)$ and $\gamma(c)$ alone. Considering both, the dynamic interfacial tension measurements and interfacial dilational rheology behavior, a comprehensive characterization of protein adsorption, thus influencing the best fit model parameters derived from $\gamma(c)$ and $\gamma(t)$, can be obtained.