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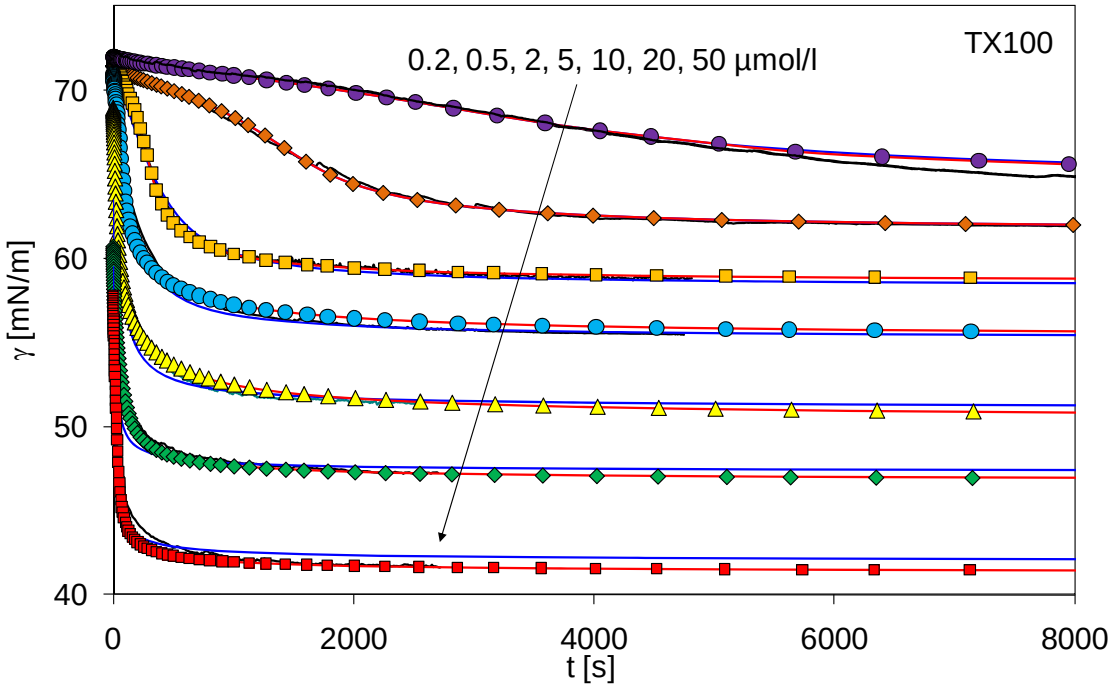
# Dynamic Surface Tensions Obtained by the Drop and Bubble Shape Tensiometer PAT-1

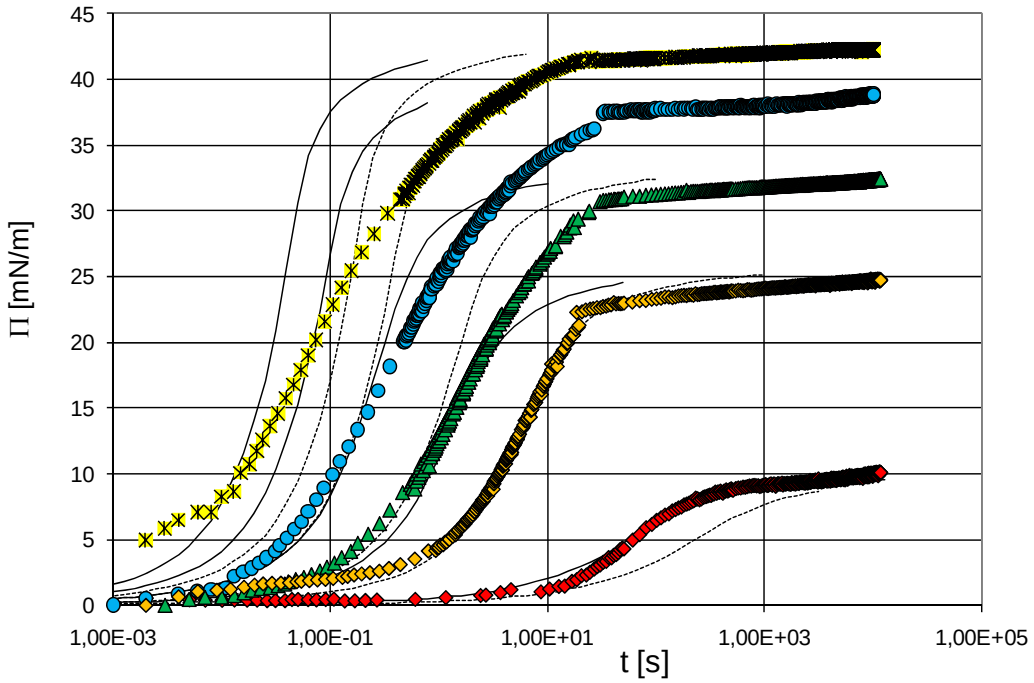
Using the PAT-1 instrument, dynamic surface tensions can be obtained. During the experiments either the drop volume or the drop surface area can be kept constant. Experimental data obtained with constant surface area are advantageous for a quantitative data analysis. The principle of this tensiometry method is best described in a chapter of a recently published book (R. Miller and L. Liggieri (Eds.), Bubble and Drop Interfaces, in "Progress in Colloid and Interface Science", Vol. 2, Brill Publ., Leiden, 2011).
The principle type of data obtained from PAT-1 with the format *.fit are given in a text format and can be imported into any graphic tool. Typically, only the adsorption time and the surface tension are needed, sometimes, however, also the change of drop area and volume with time are essential.
The software allows to display the results via MS EXCEL, to which the data can be easily exported. In the graph below, the dynamic surface tensions of sub-micellar and micellar solutions of the non-ionic (technical) surfactant Triton X-100.




Dynamic surface tensions of Triton X-100 solutions measured by the emerging bubble profile method at different concentrations; blue curves – calculations from the Frumkin model; red curves – calculations from the reorientation model

Even these data, measured for a technical surfactant, have been quantitatively analysed by theoretical models (V.B. Fainerman, S.V. Lylyk, E.V. Aksenenko, L. Liggieri, A.V. Makievski, J.T. Petkov, J. Yorke and R. Miller, Adsorption layer characteristics of Triton surfactants. 2. Dynamic surface tensions and adsorption dynamics, Colloids Surfaces A, 334 (2009) 8-15).

The drop and bubble profile tensiometry is applicable to adsorption times from few seconds up to hours (and even days). Data for less than 1 s are not accessible, however, the drop/bubble profile analysis tensiometry can be complemented by the bubble pressure tensiometry, which in turn provides data in the range of short adsorption times up to about one minute. In the graph below it is shown how the measured dynamic surface tensions for $C_{10}EO_4$ solutions of different concentration




(from top to bottom $7.5\times10^{-5}$, $1\times10^{-4}$, $2.5\times10^{-4}$, $5\times10^{-4}$, $7.5\times10^{-4}$ mol/l of $C_{10}EO_4$)

The solid and dotted lines are calculated from adsorption kinetic models, the details of which are given in J. Schulze-Schlarmann, C. Stubenrauch and R. Miller, Dynamic surface tensions of $C_{10}EO_4$ solutions measured by bubble pressure tensiometry and drop profile analysis, Tenside Surfactants Detergents, 42 (2005) 307-312.

More details on the data analysis of adsorption kinetics experiments can be found, for example, in the following book: V.B. Fainerman, D. Möbius and R. Miller (Eds.), Surfactants – Chemistry, Interfacial Properties and Application, in "Studies in Interface Science", Vol. 13, Elsevier, 2001, ISBN: 0-444-50962-3.

Our service:
- selection of the right experimental technique for a given surfactant
- measurement of dynamic surface tensions over a respective adsorption time
- data analysis and graphical representation
- analysis of the adsorption mechanism
- proposal of other complementary techniques if needed
- compare with standard surfactants
- reference to literature data
- literature analysis to the subject