STRUCTURAL STUDIES OF SURFACTANT-POLYMER ASSOCIATIONS IN BULK AND AT INTERFACES

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The surfactant-polymer association complexes of anionic surfactant dodecylbenzene sulfonate acid (DBSA) and neutral polymer polyethylene glycol (PEG) were studied in the bulk of solution by small-angle neutron scattering (SANS) [1,2] and at the surface of polymer brush system by neutron reflectometry [3]. The influence of polymer binding effect on the surfactant micelle structure clearly can be seen from SANS curves (Fig. a), scattering intensity of DBSA 3 vol. % micellar solution significantly changes after the addition of 3 vol. % PEG in solution, and cannot be represented by the sum of the scattering intensities of the polymer and micelles separately [1].
Polymer brush system of PEG (M_w = 20 kDa) was synthesized on a silica substrate using the "grafting to" method. Structural changes in the PEG polymer brush caused by the interaction with DBSA micelles were observed by neutron liquid cell reflectometry using a substrate with a titanium carrier layer for enhancing reflectivity signal (Fig. b) [3]. The effect is shown to be related to the formation of molecular polymer-micelle associates, which was previously studied by small-angle neutron scattering in a wide range of surfactant concentrations at various molecular weights of the polymer [1]. The structure of DBSA complexes in the dense medium of the PEG polymer brush under study remains unexplored and requires further investigations including the neutron reflectometry method.

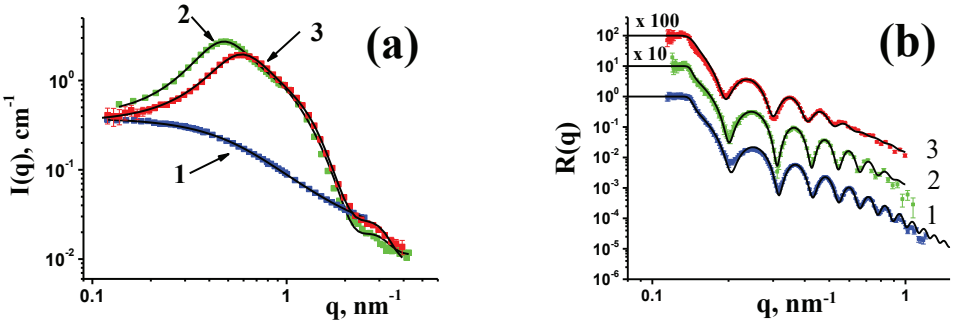

Fig. SANS data (a): scattering on PEG 20 kDa solution with 3 vol.% concentration (1), scattering on DBSA 3 vol. % solution (2), scattering on DBSA 3 vol. % + PEG 3 vol. % mixture solution (3); neutron reflectometry data (b): Si/Ti/SiO_2 substrate in the liquid cell (1), PEG polymer brush system at the substrate surface in the liquid cell (2), injection of 0.2 vol.% solution of DBSA in the liquid cell (3)

[1] O.P. Artykulnyi, A.V. Shibaev, M.M. Avdeev, et al. // *J. Mol. Liq*. (2020) 308, 113045
[2] O.P. Artykulnyi, V.I. Petrenko, L.A. Bulavin, et al. // *J. Mol. Liq.* (2019) 276, 806-811
[3] O.P. Artykulnyi, M.M. Avdeev, Ye.M. Kosiachkin, et al. // *Nucl. Phys. At. Energy* (2021) 22, 149-156.