

Langmuir films of gold sol in reverse micelles of Aerosol OT

A. V. Abakshonok¹, N. V. Karatay¹, I. V. Paribok¹, A. N. Eryomin¹,
V. E. Agabekov¹, Muhanna K. Muhanna²

¹*Institute of Chemistry of New Materials NAS of Belarus, Minsk, Belarus,
e-mail: nura2007@tut.by*

²*King Abdulaziz City for Science and Technology (KACST), Saudi Arabia*

Aerosol OT (AOT) is widely used in the microemulsion synthesis of nanoparticles (NPs) in the nonpolar medium. It was assumed that AOT can be used for the langmuir films formation, since it is slightly soluble in a water (14 g/l, 25 °C). A method for producing gold sol in reversed micelles of AOT in a mixture of chloroform – DMSO in the presence of thiol has been developed, and langmuir films were formed on its basis.

Gold sol in a mixture of chloroform – DMSO (1 : 1) containing 30–200 mM AOT, 0.5 mM thiol, 0.7 mM HAuCl₄ and 7.0 mM NaBH₄ was prepared. Gold NPs were functionalized by 4-mercapto-1-butanol (MB), 1-hexadecanethiol (HDT), 2-aminoethanethiol (AET), mercaptoundecanoic acid (MUA). If AOT concentration in the synthesis medium was less than 200 mM, gold NPs aggregated during storage. Thiols affect the aggregative stability of gold sol in the micellar medium which decreases in the series MB > AET > without thiol > HDT ≈ MUA

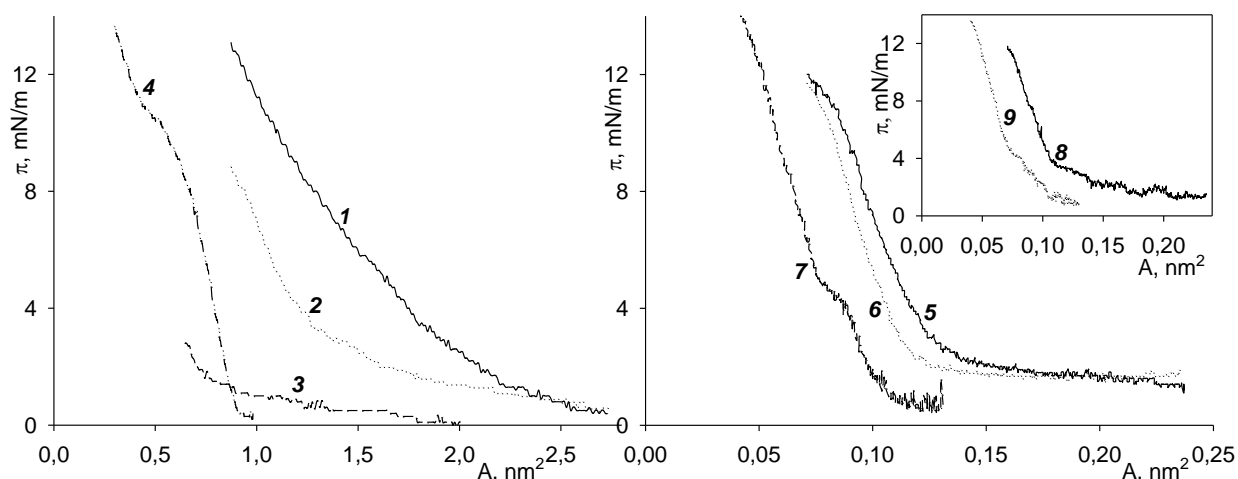


Fig. Surface pressure – area per molecule isotherms for monolayers of AOT dissolved in the chloroform (1) or the mixture of chloroform – DMSO (2–9) containing MB (3), 60 mM AOT and gold NPs (4), 200 mM AOT, gold NPs (5–9) and MB (6) or AET (7), HDT (8) and MUA (9)

Monolayer of AOT formed as in the presence of DMSO (Figure, isotherm 2) and thiol (isotherm 3) so without it (isotherm 1) is unstable because most of AOT molecules dissolve in the aqueous subphase. In this case compressibility of langmuir films does not depend on the amount of the AOT deposited on the subphase and is equal to 0.042 ± 0.004 mN/m. The presence of gold NPs in the AOT monolayer (isotherms 4–9) decreases its compressibility indicating more dense packing of the molecules in the monolayer. Thus in the presence of gold NPs functionalized by MB (isotherm 6) the compressibility of AOT monolayer decreases to 0.031 m/mN.