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Determination of pseudo-refractive index in self-assembled ligand layers from spectral shift of surface plasmon resonances in colloidal silver nanoplates

<https://doi.org/10.1515/zpch-2020-1786>

Received November 25, 2020; accepted April 7, 2021;

published online April 23, 2021

Abstract: We examined systematically how self-assembled monolayers (SAMs) of different mercaptoacids affect the spectral shift of the localized surface plasmon resonance in silver nanoplates and nanospheres. We observed a clear trend in the magnitude of a redshift with a molecular length or the SAM thickness within a homologous series of aliphatic mercaptoacids: the thicker shell the stronger the red shift. Using classic Mie theory for plasmonic core-dielectric shell spheres and oblate spheroids we developed the method for determination of a pseudo-refractive index in SAM of different molecules and obtained a good correlation with the reference refractive indices for bulk long-chain aliphatic acids, but only in case of silver nanoplates. Calculations for silver core-shell nanospheres gave overestimated values of refractive index perhaps due to restrictions of Mie theory on the minimum particle size.

Keywords: localized surface plasmon resonance; pseudo-refractive index; red shift; silver nanoplates; surface ligand.

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Documents

Export Date: 21 Dec 2021

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[Determination of pseudo-refractive index in self-assembled ligand layers from spectral shift of surface plasmon resonances in colloidal silver nanoplates](#)
(2021) Zeitschrift fur Physikalische Chemie, 235 (12), pp. 1831-1848.
- 1) <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105732728&doi=10.1515%2fzpch-2020-1786&partnerID=40&md5=27>
DOI: 10.1515/zpch-2020-1786

Document Type: Article

Publication Stage: Final

Source: Scopus