Surface Plasmon Resonance investigation of clay and organo-clay film formation on Au/water interface

Koutsopoulou Eleni[1,2], Papagiannopoulos Aristeidis[3], Christidis Georgios[1*],

[1] Technical Univ. Crete, Department of Mineral Resources Engineering, 73100 Chania, Greece
[2]Institute of Geological and Mineral Exploration (IGME), 13677 Acharnes, Greece
[3]Theoretical and Physical Chemistry Institute, NHRF, 11635, Athens, Greece

*christid@mred.tuc.gr

Hybrid organic–inorganic films are extensively studied for their potential use in a variety of advanced industrial and technological applications. Clay minerals and especially smectites, are widely used for the preparation of functional nanofilms [1] because of their excellent intrinsic properties. Functional molecules, such as alkylammonium surfactants, can be adsorbed on the clay mineral surfaces prior or subsequent to the film formation, leading to well-designed functional clay films [1].

Surface Plasmon Resonance (SPR) is a surface oriented method for the characterization of thin films and monitoring processes at metal interfaces, which has been used to investigate film formation and structural changes of clay minerals [2]. SAz-1 (high charge) and STx-1b (intermediate charge) montmorillonites obtained from the Source Clays Repository of the CMS were selected based on their layer charge and SPR was employed for the in-situ investigation of film formation from clay minerals aqueous dispersions on Au/water interface.

Both smectites adhere on the gold surfaces irreversibly producing stable clay films. Layer charge and charge distribution seems to affect the kinetics of film formation but also the total amount of clay adhered on the gold substrate. The kinetics adhesion is mainly controlled by concentration for both clays and clay film formation is dominated by the layer charge of the different clay minerals which affect the total adsorbed amount of clay on the gold substrate.
After the formation of stable clay films, hybrid organo-clay films were in-situ prepared with the introduction of alkylammonium chains in the SPR cell and their adsorption kinetics was examined. Alkylammonium molecules adsorb via ion exchange in the interlayer of clay minerals and the adsorption is controlled by the density of the clay film in full accordance with layer charge and charge localization. Therefore, a new method to construct hybrid organo-clay functional films for novel applications is proposed.

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