Direct Observation of the Empty Liquids Formation by Surface Plasmon Resonance

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Colloid systems with tunable properties and functionality are very perspective for the bottom-up approach to the self-assembled nanomaterials. From this point of view empty liquids presenting liquid states with vanishing density are of special interest. Here we demonstrate the approach to the investigation of the formation of the empty liquid state by laponite nanoplatelets known by its' possibility to form a solid-like transparent gel. A simple and convenient way for determination of effective optical parameters of complex environments is the surface plasmon resonance (SPR) method. It has been widely used to characterize both various solutions and thin organic films on metal surfaces. In the present work, we demonstrate the aging of aqueous suspension of laponite (2% wt) after the dissolution and homogenization. To our knowledge, it is the first direct on-line observation of the formation spatially organized gel with decreasing refractive index of materials in respect the homogeneous solution of the same components.

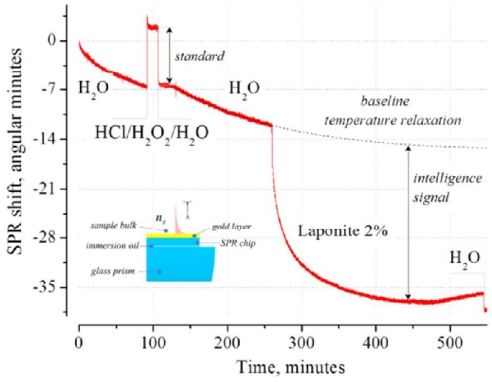

Figure. Typical SPR responses at various stages of surface clearing and formation of gel from initially homogeneous laponite suspension.
Inset: schematic arrangement of the optical components the SPR system at the interface.

Figure demonstrates the dramatic change of the optical properties of the suspensions. The modeling of the variation of the SPR response using Fresnel formalism (Winspall) indicates that observed changes may be explained by the decreasing the bulk refractive index of the formed materials. During the aging the electrokinetic potential of 2% laponite suspension was also studies. It increased from -48 mV (at t=0 min) to -62 mV (t=20-120 min). After this period of time (t more than 120 min), the zeta-potential became constant. Such changes can be explained by the transfer from glass-like to gel-like structure of the investigated system.