Analysis of Metal Ion Adsorption on Thiol Functionalized Surface by SPR Spectroscopy

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Surface Plasmon Resonance Spectroscopy (SPRS) is a powerful tool for the characterization of solid/liquid interface. As a noninvasive real time surface analytical method, this technique is able to monitor an in-situ interaction of analyte and ligand on surface without labeling of reactant such as spectroscopic and radioactive probe. SPRS detects the refractive index (RI) change at the boundary of surface, in the range of submicron (about 300 nm in this study). The change of RI results in the SPR angle shift in ATR (Attanuated Total Reflectance) curve. In this study, SPRS was applied for the analysis of metal ion adsorption on the surface at the molecular level. 1,6-hexanedithiol was used as an adsorption-inducing chemical. Potassium tetrachloroplatinate was used to prepare a solution of metal ion. Microscope slide glasses (1-inch × 1-inch SF10) were immersed in a piranha solution (H_2SO_4 : H_2O_2 = 7:3 v/v) for purification. They were rinsed several times with DI water and ethanol and dried. The 50-nm gold thin film was prepared by thermal evaporation with a 5-nm Cr adhesion layer. A cleaned gold substrate was attached to a SF10 prism with index matching oil (n = 1.730 ± 0.0005). A Teflon cell with micro-channel was attached to the gold substrate. The 635-nm diode laser was p-polarized and focused with a lens through the prism onto the gold substrate. Both the prism and the gold substrate were mounted on a rotating plate to control the angle of the incident light. The reflectance was measured with a photo-detector. The change in reflectance was converted to SPR angle shift. During the monitoring of the reflectance, Pt ion solution flowed into a Teflon cell through a micro-channel. Molecular level adsorption kinetics of Pt ions to HDT ligands were obtained. It was determined that the adsorption kinetics has a 2-phase shape. Result

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implied that the hydrophobic surface of thiol ligands hinder the transfer of metal ions through the boundary layer. This technique has been demonstrated to be capable of in-situ monitoring of metal ions at the molecular level.

Keywords: SPR, in-situ, kinetics, metal ion, adsorption, surface, spectroscopy
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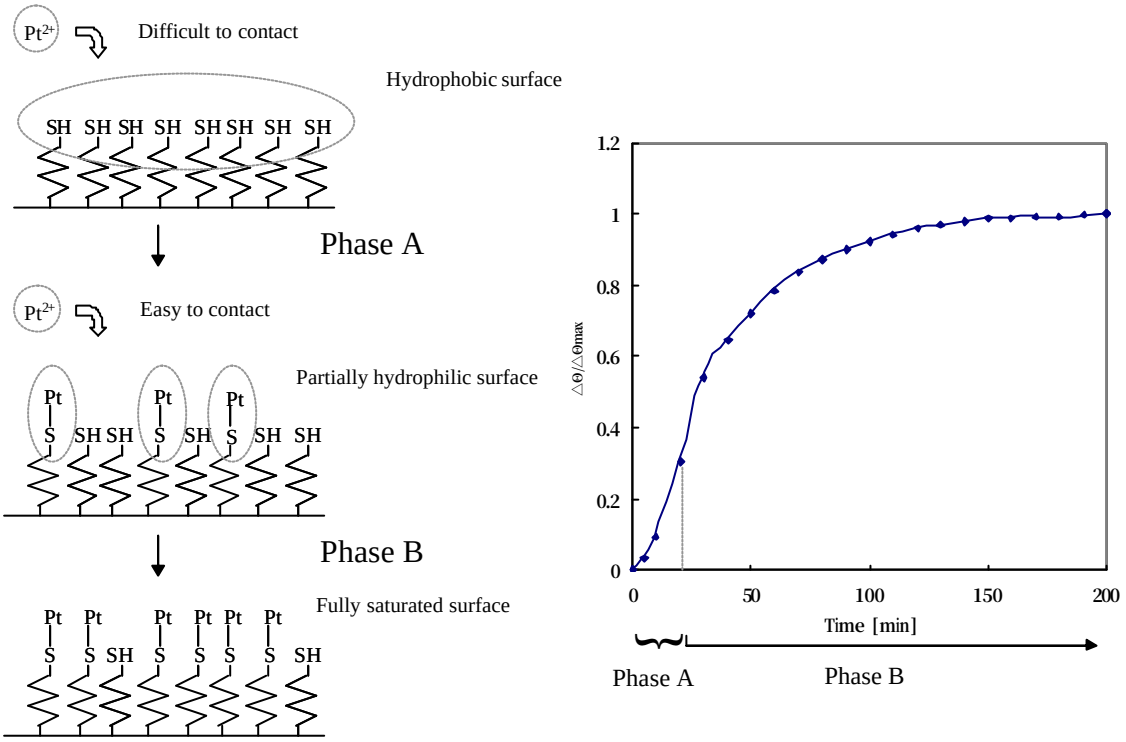

Figure. Schematics of 2-phase metal ion adsorption on thiol functionalized surface and the adsorption kinetics.