Kinetic and plasmonic properties of gold nanorods adsorbed on glass substrates

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Abstract

Monodisperse gold nanorods with different sizes were synthesized and adsorbed on chemically modified glass substrates. Influence of surfactant molar concentration on nanorod adsorption was studied and the optimum range was determined. During substrate coverages we monitored the growth of longitudinal localized surface plasmon resonances at short times due to density increase of isolated nanorods and, at longer times, their subsequent decrease and a concurrent growth of coupling resonances owing to nanoparticle surface mobility and aggregation. Temporal evolution of amplitudes of resonance peaks in extinction spectra and nanorod counting statistics in electron micrographs were used to model both coverage and aggregation processes, as exponential-like functions of time. Their characteristic times and saturation values were analyzed and related to kinetic parameters, nanorod dimensions and extinction coefficients. This work can be used as a predictive tool to prepare plasmonic substrates with desired optical resonances.

KEYWORDS: Plasmonics, Gold nanorods, Coverage and aggregation, Localized surface plasmon resonances, SERS substrates