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Plasmonic Control of Molecule Diffusion at Electrified Interfaces in Solutions

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We have developed structural control of plasmonic metal nanodimer in nanoscale for the development of the light confinement [1]. Strong interaction between localized surface plasmons and excitons in materials and molecules results in exotic electronic excitations, such as non-zero-wavevector, multipolar, and orthogonal transitions [2-4]. Under such resonant condition, enhanced absorption of photon could modify chemical potentials of molecules effectively. As well as potential energy, kinetic energy of molecule could be also affected via applying optical force, because of strong electric field gradient in molecule scale due to the light localization. Although optical tweezers are well recognized in the wide research field. Until now it has been recognized that small molecule trapping is still difficult at room temperature especially in solution. In this presentation, we would like to discuss about the possibility to use metal nanostructures for optical manipulation of molecules adsorbed on the surface by confined light [5-7]. We can show that plasmonic structure enables to concentrate bi-analyte small molecules via the observation of electrochemical surface-enhanced Raman scattering. As the results, not only the condensation of molecules but also the molecular selective condensation have been conducted via the control of the molecule diffusion on metal surface because of the strongly localized plasmonic field.

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