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Nanoscale Detection of Surface Plasmon-driven Hot Electron Flux on Au/TiO_2 Nanodiodes with Atomic Force Microscopy

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Electrons with high kinetic energy (1-3 eV) can be generated in metals during surface reaction processes. These energetic electrons are called “hot electrons”. A way to detect these hot electrons is by using metal-semiconductor Schottky diode. It was proposed that enhanced light absorption with localized surface plasmon resonance results in amplified hot electron generation by utilizing Au/TiO2 Schottky diodes. In this scheme, the surface morphology of the metal thin film was modified to a connected gold island structure that exhibits surface plasmons.[1,2]

To probe the enhanced hot electron flows by surface plasmon, we fabricated patterned Au islands on TiO_2 diodes using e-beam evaporator, [3] and measured the local photocurrent with the conductive probe atomic force microscopy under back illumination of the light. The gold pattern has triangle shape with the length of the hypotenuse of 150 nm and the thickness of 20 nm. We found that the photocurrent depends on the wavelength of laser, and the bias between Au and TiO_2. The photocurrent measured at the edge of the Au islands was higher than that on the flat area of Au islands. The result indicates the localized surface plasmon resonance leads to enhancement of hot electron flux.

Reference

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