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Title: Surface Second Harmonic Generation (SHG) on the Au/TiO₂ (320) Interface and Bare TiO₂ (320)

Author(s) Name: Md. Ehasanul Haque, Daiki Kobayshi, Yuki Tomatsu, Khuat Thi Thu Hien, Goro Mizutani and Harvey N. Rutt

Contact Email(s): ehasanul@aiub.edu

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Abstract:

The study of electronic states of the Au/TiO₂ interface is very important for the development of the catalyst field. We fabricated an Au thin film on the TiO₂(320) substrate with the thickness of 2nm deposited in a UHV chamber at pressure of 2×10^{-7} Torr. We observed the SHG response from the Au/TiO₂(320) interface and bare TiO₂(320) as a function of the rotation angle of the samples around their surface normal using both 1064 nm and 532 nm wavelength of pulsed Nd²⁺:YAG laser light. The isotropic response was found from both samples when using 1064 nm wavelength. In contrast, we observed anisotropic response from both samples when using 532 nm wavelength. The observed anisotropic SHG signal proved that the electronic resonance from the Au covered stepped TiO₂(320) substrate occurred at the ultraviolet region around 266 nm with the photon energy of 4.66eV. From the Au/TiO₂(320) interface, an anisotropic structure was observed to the [-230] direction for Pin/Pout polarization combination. From the experimental data, we theoretically decomposed the nonlinear susceptibility elements. It is found that there are two groups of the nonlinear susceptibility elements corresponding to step and terrace contribution to the anisotropic SHG response. The analysis provides the information about the electronic states of Au/TiO₂(320) interface and that is intimately related to the catalytic activity of the Au/TiO₂ interfaces.