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Abstract:

Au supported by metal oxides and semiconductors is known to exhibit high catalytic activity. Since Au particles supported by TiO2 exhibit catalytic activity independent of the environment, Au/TiO2 has attracted a great deal of attention in recent years and has been studied extensively. However, the reason why Au/TiO2 exhibits catalytic activity is still not fully understood. Since the Au/TiO2 junction interface is considered to be a likely cause, a method to detect information at the interface is required. The information obtained by many observation methods contains a lot of bulk information, and it is generally difficult to distinguish only the interface. In this study, we observed the electronic state of the Au-modified step using SHG spectroscopy, which has strong selectivity for surfaces and interfaces. The sample was a surface treatment of the (320) plane, which is a slightly inclined plane from the (110) plane of a rutile type TiO2 single crystal, and a 2 nm Au was deposited. A three-fold wave of an Nd:YAG laser (pulse time width: 30 ps, repetition rate: 10 Hz) excites an optical parametric generator (OPG) to generate visible light, and the intensity and direction of polarization of the laser light are controlled through an optical element such as a polarizer, and the sample is irradiated. The intensity of SHG from the sample was measured while changing the wavelength of incident light with OPG, detected by a photomultiplier tube, and recorded. A α-SiO2 (0001) reference sample was used to correct fluctuations in light source intensity and sensitivity changes due to the wavelength of the detector. As a result, it was found that the energy of SHG photons increased between 4.2 eV and 5.2 eV. This is thought to be due to the amplification of the SHG signal by one-photon or two-photon resonance. However, it is not yet possible to determine whether a two-photon resonance occurred or a one-photon resonance at this stage. This can be determined by further using the sum frequency generation method. There was also a weak SHG response between 2.2 eV and 3.2 eV. In this lecture, we will discuss possible interfacial electronic states.