S-04

Space-, Time-, and Energy-Resolved Two-Photon Photoelectron Spectroscopy

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Electron transfer processes at organic-molecule/metal interfaces are important in the development of light emitting diodes and solar cells.(1) Femtosecond time-resolved two-photon photoelectron (TR-2PPE) spectroscopy is a powerful tool to study the ultrafast dynamics of charge carriers on solid surfaces and interfaces.(2) Recently a time-of-flight photoelectron emission microscope (TOF-PEEM) became commercially available,(3) which makes possible a space-resolved TR-2PPE experiment. This report is divided by two parts: (1) ultrafast decay dynamics of the electronics states of Alq_3/Cu interfaces, and (2) space-resolved ultrafast electron relaxation dynamics in Ag-coated Si nanostructures as a demonstration of the first commercial TOF-PEEM.

Ultrafast decay dynamics of the electronic states of Alq_3/Cu interfaces was investigated by interferometric time-resolved two-photon photoelectron spectroscopy. The work function decreased as an increase of Alq_3 thickness. At Alq_3/Cu(111) interface, the anion state lifetime of Alq_3 adsorbed was reported as 31±2 fs by a phase averaged experiment.(2) By the interferometric measurements we studied dephasing and population relaxation dynamics at Alq_3/Cu(111) and Alq_3/Cu(100) interfaces.

Space-resolved ultrafast electron relaxation dynamics in Ag-coated Si nanostructure was investigated by TR-TOF-PEEM.(4) The photoelectron intensity excited by frequency doubled 400 nm of Ti:sapphire laser is enhanced at a topographical edge, the spectrum of which was characterized by the lower work function. Time-resolved spectra between the edges and other flat areas were compared.

[References]

1. D. Ino, K. Watanabe, N. Takagi, and Y. Matsumoto, Phys. Rev. B **71**, 115427 (2005).
2. H. Petek and S. Ogawa, Prog. Surf. Sci. **56**, 239 (1997).
3. A. Oelsner, O. Schmidt, M. Schicketanz, M. Klais, and G. Schönhense, V. Mergel, O. Jagutzki, H. Schmidt-Böcking, Rev. Sci. Instrum. **72**, 3968 (2001).
4. C.-K. Min, J. W. Kim, and Y. Park, Surf. Sci. submitted.