Spectroscopic Imaging by Time-of-flight Photoemission Microscopy

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According to the advance of electron optics and fast pulsed light source, an energy and time-resolved imaging in real time has been possible. Since the pioneering work by Schönhense's group [1], such an instrument became commercially available. We demonstrate results obtained from the time-of-flight photoemission microscopy (TOF-PEEM) [2] which is the first such instrument that is commercially available. The TOF-PEEM consists of three electrostatic lenses in front, drift tube for the TOF, and delay line detector (DLD) at the end. The PEEM optics with an integrated sample stage (Focus GmbH) delivers a lateral resolution of about 60 nm. The DLD (Surface Concept GmbH) has high temporal resolution (120 ps) and count rate (2.5 MHz per channel) with a pixel resolution of about 900x900. Frequency doubled 400 nm femtosecond laser pulses from modified Ti:S laser and BBO crystal was used for the excitation source. Using pump-probe 2 photon photoemission technique, we show an example of spatially-resolved ultrafast time evolution of interface electronic states of organic semiconductor materials on different substrates using the TOF-PEEM and conventional surface analysis techniques such as ultraviolet and x-ray photoelectron spectroscopy.

[1] A. Oelsner, O. Schmidt, M. Schicketanz, M. Klais, and G. Schönhense, V. Mergel, O. Jagutzki, and H. Schmidt-Böcking, Rev. Sci. Instrum. **72**, 3968 (2001)
[2] Omicron Nanotechnology