Spectromicroscopic Characterization of Monomolecular Lithographic Patterns: the Effect of the Substrate

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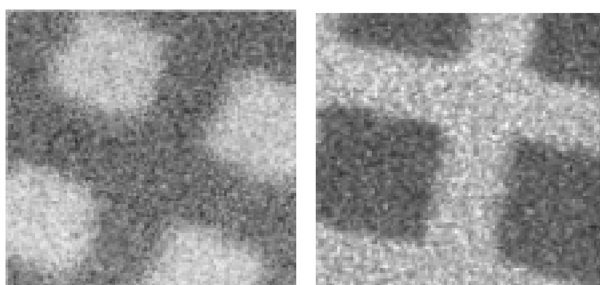
Patterned self-assembled monolayers (SAMs) of alkanethiols (AT) on Au and Ag substrates were imaged and characterized by a scanning photoemission microscope (SPEM) setup. The patterns were prepared ex situ by electron irradiation of the pristine SAMs through a mask and subsequently exposed to ambient before their characterization in the SPEM chamber. The spectromicroscopic contrasts observed in the SPEM images resulted from a complex interplay of several competing processes [1]. On one hand, desorption of molecular fragments and chemical modification of the residual hydrocarbon layer occurred during the SAM irradiation. On the other hand, the fabricated patterns were further modified during their exposure to the ambient, which occurred through the adsorption of airborne molecules on the irradiated areas, possessing chemically active sites and enhanced surface roughness. Although the extent of the latter effect was assumingly the same for both Au and Ag substrates, the respective C 1s SPEM images showed opposite contrasts, which was attributed to the differences in the binding energy positions for the different carbon components in AT/Au and AT/Ag. The results for the electron-beam-patterned SAM resists will be compared with the analogous data for the monomolecular films patterned in situ by the focused X-ray beam.



C1s SPEM images of electron-beam patterned hexadecanethiol SAMs on Au (left image) and Ag (right image). The images exhibit opposite contrasts, which are related to the interplay of several competing effects.

[1] R. Klauser, I.-H. Hong, S.-C. Wang, M. Zharnikov, A. Paul, A. Gölzhäuser, A. Terfort, and T. J. Chuang J. Phys. Chem. B 107 (2003) 13133.