

# Molecular Nano-structures with Strong Dipole Moments on the Si (111) 5×2-Au Surface

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Organic molecules adsorbed on the silicon surface combines the flexibility and the low cost of molecular devices with the sophistication of modern silicon device technology. The first step toward creating such hybrid devices is the formation of regular, ordered patterns of molecules on a silicon surface. We find that stepped Si surfaces passivated by a sub-monolayer of gold provide promising substrates for forming molecular lines, which are useful for data storage devices (Fig. 1). Local barrier height measurements by Barrier Height Imaging (BHI) demonstrate the possibility to detect the direction of dipole moments of individual molecules. Angular dependent NEXAFS measurements at the SRC indicate ordered structures in both the azimuthal and polar directions (Fig. 2 and Fig. 3). This system can serve as a model structure for designing single molecule memory devices [1-3].

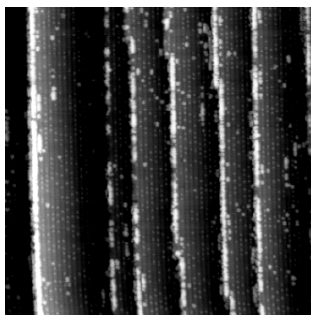


Figure 1. 2, 3, 4-trifluorophenol molecules decorating the step edges of the Si (111) 5×2-Au surface.

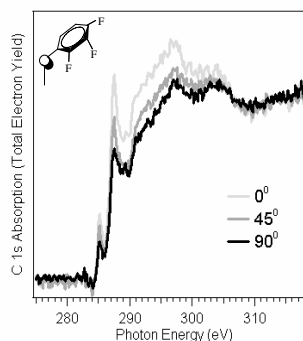


Figure 2. Azimuthal polarization dependence of NEXAFS spectra from 2, 3, 4-trifluorophenol on Si (111) 5×2-Au, showing azimuthal orientation of the molecules at step edges.

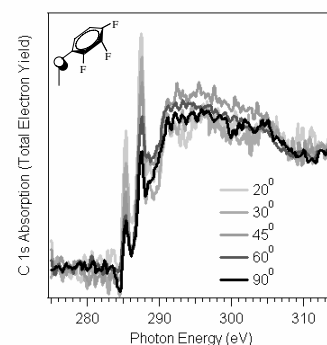


Figure 3. Polar polarization dependence of NEXAFS spectra from 2, 3, 4-trifluorophenol on the Si (111) 5×2-Au, showing a preferred polar tilt angle.

## References:

- [1] K. Matsushige and H. Yamada, *Ann. N.Y. Acad. Sci.* **960**: 1–15 (2002). © 2002 New York Academy of Sciences.
- [2] Akira Sakai, in *Advances in Scanning Probe Microscopy*, edited by T. Sakurai and Y. Watanabe, Springer-Verlag, 2000. Chapter 6
- [3] Fan Zheng, I. Barke, Xiaosong Liu and Franz Himpsel, in preparation