

STM-experiments on aza-BODIPY

J. Meyer, A. Wadewitz, C. Toher, Lokamani, F. Moresco, G. Cuniberti

Faculty of Mechanical Engineering, Institute for Materials Science, Chair 'Materials Science and Nanotechnology'

Introduction



Aza-BODIPY

- Class of organic fluorescent dyes
- Characterized by azadipyrromethene boron complex
- 1,3,5,7-tetraphenyl-8-azadipyrromethene
- $\lambda_{abc} = 650 \text{ nm in CHCl}_{2}$
- λ_{abs} up to 800 nm with varying side groups
- Currently used in immunostaining, PDT and OPVs • B = grey; C = black; F = green; H = blue; N = orange



Createc LT-STM/AFM system

- 3 chamber UHV system with base pressure of 5 x 10⁻¹¹ mbar • Operated at 5 K Molecular beam epitaxy
- Tuning fork AFM

• Synthesis by Institute for Applied Photophysics, Technische Universität Dresden



Titanium sublimation pump Valve Ion getter pump

Imaging

Simulations

- Relaxed state on Au(111) 5 eV lower then unrelaxed
- Molecule flattens on surface
- Various orientations with minor energy differences
- Phenyl groups flatten on surface
- LDOS mainly contributed by C

Experiments

- Constant current mode
- Imaging parameters: I = 0.5 to 1.2×10^{-11} A U = -0.3 to -0.7 V
- Molecule flattens on surface
- Adsorption regardless of herring bone structure
- No distinct surface orientation
- Bright spots correspond to phenyl groups



Simulated STM-image (U= -1.0 V, left); PDOS-spectrum of relaxed molecule on Au(111) surface (right)



3D picture



Spectroscopy

• No visible features from N or F atoms







I = 5.5 x 10⁻¹¹ A; U = -0.50 V; image size: 284 Å x 152 Å



• Au(111) surface state at -510 meV on blank Au surface

Additional broad peak at 650 meV on molecule



Manipulation



Acknowledgments

• ECEMP – European Center of Emerging Materials and Processes Dresden (Project A2) for funding

InnovaSens for funding

complex

• IAPP (TU Dresden) for synthesis

• ZIH for computational resources



ZIH





Europäischer Fonds für regionale Entwicklung

This work was funded by the European Union and the Free State of Saxony.

materials

http://nano.tu-dresden.de

12/2010