

Probing assembly, vibrational excitations and switching at the molecular level

Johannes Barth, *jvb@tum.de*

Physik-Department E20, TUM, Garching, Bavaria, Germany

The control and organization of molecular species is key to advance molecular science, organic electronics and the development of novel functional materials. We notably explore interfacial bonding, assembly and dynamic behaviour at well-defined homogenous surfaces, textured templates and sp²-sheet layers using scanning probe microscopy and complementary techniques. The developed bottom-up fabrication protocols employ biological and *de novo* synthesized building blocks, and implement error-corrective supramolecular bonding schemes as well as covalent chemistry. We thus advance the interfacial control of single molecular units and the design of nanoarchitectures with special structural features, intricate dynamics and tailored properties. Moreover, chemically-sensitive techniques for single-molecule electronics are described, notably addressing the fundamental challenge to quantitatively determine charge-vibrational coupling in well-defined single-molecule junctions. We thus explore current-carrying tethered molecules by combined vibrational and metal-molecule-metal junction current-voltage spectroscopy and the conformational response of a two-state molecular switch.

Recent key publications: *Acc. Chem. Res.* 51, 365 (2018); *JACS* 140, 4835 (2018); *Nat. Chem.* 10, 296 (2018); *Nat. Chem.* 9 33 (2017); *Nat. Chem.* 8, 657 (2016); *Nature Chem.* 7, 105 (2015); *Nat. Comm.* 7, 10700 (2016); *Nano Lett.* 15, 2242–2248 (2015); *Acc. Chem. Res.* 48, 2140 (2015); *Nature Nanotech.* 7, 41 & 673 (2012).