Single Molecule Junctions

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Molecules are the smallest building blocks still providing the structural diversity required to address particular electronic functions. The achievements in synthetic chemistry making tailor-made molecules available raised the interest of electronic engineers to profit from these tiny building blocks to meet the requirements of the ongoing miniaturization in electronic circuits. While the concept of integrating molecules in electronic circuits inspired numerous theorists and remained for long time an academic challenge, recent developments report first massive parallel and CMOS compatible integration strategies.[1]

The presentation will be focused on single molecule transport experiments addressing structure-property correlations in order to investigate the potential and the limitation of molecules as functional electronic building blocks. Entire series of molecules were initially synthesized to proof that indeed single molecule junctions are obtained, like e.g. a series of biphenyl derivatives with fixed inter-phenyl torsion angles.[2] Recently we geared our interest towards molecules responding on external triggers, like *E*-field sensitive structures realized by spin cross-over complexes,[3,4] fixed molecular platforms exposing dipole moment comprising cantilevers,[5] or macrocyclic turnstile structures.[6] An even newer approach are mechano-sensitive structures responding on the alteration of the electrode spacing. While initial experiments were based on compact [2.2]paracyclophanes,[7,8] also considerably larger molecular architectures like porphyrin cyclophanes display pronounced mechanosensitivity.[9,10,11].

[1] G. Puebla-Hellmann et al. *Nature*, **2018**, *559*, 232-235. [2] D. Vonlanthen et al. *Angew. Chem. Int. Ed*. **2009**, *48*, 8886-8890. [3] G. D. Harzmann et al. *Angew. Chem. Int. Ed*. **2015**, *54*, 13425-13430. [4] T. Brandl et al. *Eur. J. Org. Chem.* **2019**, 5334-5343. [5] L. Gerhard et al. *Nature Commun*. **2017**, *8*, 14672. [5] L. Le Pleux et al. *Eur. J. Org. Chem*. **2017**, 3165-3178. [6] R. Frisenda et al. *Nano Lett*. **2016**, *16*, 4733-4737. [7] D. Stefani et al. *Nano Lett.* **2018**, *18*, 5981-5988. [8] K. Reznikova et al. *J. Am. Chem. Soc.* **2021**, *143*, 13944-13951. [9] P. Zwick et al. *J. Org. Chem.* **2020**, *80*, 15072-15081. [10] W. M. Schosser et al. *Nanoscale* **2022**, *14*, 984-992. [11] C. Hsu et at. *Chem. Sci*. **2022**, *13*, 8017-8024.