Controlled bottom-up assembly of functional molecules: From wires to networks

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On-surface reactions are a promising approach in view of synthetizing sophisticated structures that might have important role in the field of novel nanostructures and molecular electronics. The talk will be an overview of our achievements and efforts in assembling functional molecules into controlled and stable covalently bound architectures by on-surface synthesis [1], from one-dimensional molecular wires to two-dimensional networks. The growth and complexity of the assembled structures can be tailored by suitably designing the molecular building block species. This opens up the possibility for a fine-tuning of the chemical structures that precisely defines the interaction between the molecules and hence the final architectures. We employed a sequential linking process for the formation of complex heterogeneous network structures that allows a better control of the growth mechanism and an improved quality of the networks, i.e. larger size and reduced defects [2]. Low-temperature scanning tunneling microscopy has been used as unique tool to obtain high resolution imaging of molecules at surfaces and furthermore providing the capability to manipulate matter at the atomic scale level. We have developed a new manipulation method to measure the conductance of individual molecular wires as a function of their length by pulling individual wires off the supporting surface [3,4]. Recent results on various molecular wires will be discussed.

[1] L. Grill et al., *Nature Nanotechnology* 2, 687 (2007); [2] L. Lafferentz et al., *Nature Chemistry* 4, 215 (2012); [3] L. Lafferentz, F. Ample, H. Yu, S. Hecht, C. Joachim, L. Grill, *Science* 323, 1193 (2009); [4] M. Koch, F. Ample, C. Joachim, and L. Grill, *Nature Nanotechnology* 7, 713 (2012)