Ultra-sensitive force detection and molecular manipulation

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The PhD candidate will develop a low temperature (4K) AFM based on a micro fabricated Si-cantilever using the beam deflection detection method. The construction of the system will be strongly supported by the existing knowledge in our group on the development of various RT-AFMs and the LT pendulum AFM. Key parameter of the system will be a minimum working temperature of 4K, a bandwidth of the photodetector system of 3MHz and a minimum detectable force of 0.1pN. Once the system is running, the performance will be tested rigorously on standard samples. In cooperation with S. Decurtins from University of Bern donor-acceptor molecules will be designed for optimized molecule surface interaction. The following topics will be addressed during the PhD project:

- Determination of the energy landscape by nc-AFM of molecular networks and molecular modules, which are intended to host other molecules (functional molecular networks). Energy landscape of functional end groups determined by 3D-force spectroscopy.
- Locally induced molecular movements. Single molecules and atoms will be reproducible moved by the influence of the beam deflection LT-AFM tip, the needed force and energy for this process will be determined.
- Optical excitation of molecular structures. Excitation of single (acceptor-donator) molecules by visible light and direct observation of the process by LT-AFM.

In summary, the main focus of the PhD project will be the analysis and characterization of mechanical conversion and optical absorption processes and the evolution of charge in molecular structures by beam deflection low temperature nc-AFM with ultimate force resolution.

For more information see: http://nanolino.unibas.ch/

[1] R. Pawlak et al., ACS Nano 6, 6318-6324, (2012).
[2] S. Kawai et al., Phys. Rev. B 84, 085429, (2011).
[3] T. Glatzel et al., Appl. Phys. Lett. 94, 063303, (2009).