Spectroscopy of thin molecular films under ultrahigh vacuum conditions using an optical nanofiber

David Papencordt
University of Mainz, Germany

The guided modes of optical nanofibers with diameters smaller than the wavelength of the guided light exhibit a pronounced evanescent field. The absorption of light by molecules deposited at the fiber surface is therefore readily detected by measuring the fiber transmission. We have shown that the resulting absorption for a given surface coverage can be orders of magnitude higher than that for conventional surface spectroscopy. The measurements were performed on sub-monolayers of 3,4,9,10-perylene-tetracarboxylic dianhydride (PTCDA) molecules at ambient conditions, revealing the agglomeration dynamics on a second to minutes timescale [1].

We set up a new experimental apparatus which integrates the nanofiber under ultrahigh vacuum (UHV) conditions in order to gain better control over the system. Firstly, this arrangement enables us to produce a homogeneous flux of the molecules deposited onto the nanofiber. Furthermore, it allows us to desorb pollutants (water, etc.) from the fiber and thus to work with a better defined surface. The measured absorption spectra of the deposited molecules and their time evolution are compared with the results obtained at ambient conditions. Moreover, the new setup will allow us to carry out spectroscopy on a much larger variety of molecules including those not stable when sublimated at ambient conditions.

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References:

[1] F. Warken et al., Opt. Express **15**, 11952-11958 (2007)