SPECTROSCOPIC ELLIPSOMETRY CHARACTERIZATION OF HYBRIDIZATION OF DNA ON GOLD SURFACES

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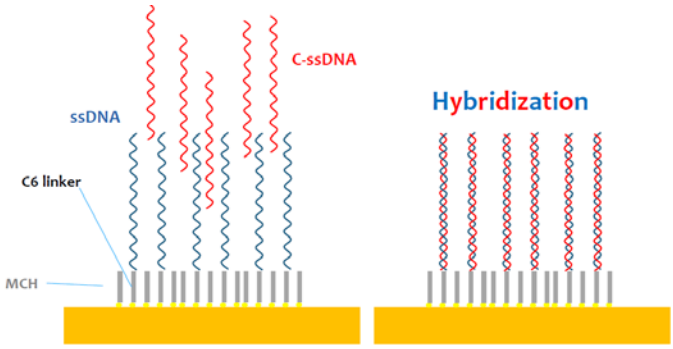

We recently coupled Spectroscopic Ellipsometry (SE) and AFM nanolithography methods to investigate the bonding of biomolecules at gold surfaces functionalized with well-organized compact thiolate Self-Assembled Monolayers (SAMs). AFM nanolithography was employed in so-called nano-shaving and nano-grafting modes [1,2] allowing precise determination of height of SAMs, which is important to feed the SE analysis. We present SE results (in-liquid and ex-situ) on a system of importance in the design of biosensors. Experiments on single-stranded ss-DNA were devoted to the detection of specific bonding through hybridization with complementary strands (c-DNA). The SE analysis of the precursor SAM, performed through the difference spectra method, allowed to disentangle the spectral features characteristic of the ss-DNA molecules and the molecule-surface bond. In particular a strong absorption in the UV range (260-270 nm) was detected in both in-situ and ex-situ data which was reproduced by a multi-oscillator model, consistently with known spectral response of DNA basis. The SE analysis with difference spectra was also able to clearly detect the hybridization process in mixed SAMs of ssDNA with mercaptohexanol (MCH), a short thiolate molecule which, through interaction with the C6 linker of ss-DNA (see cartoon) favors a standing-up organization of ss-DNA on the surface, in turn helping Hybridization. The influence of Hybridization on SE spectra turned out to be equivalent to a thickness increase of the film, which was confirmed by AFM nanoshaving. Control experiments performed by exposing the precursor ss-DNA layer to non-complementary DNA strands revealed no spectral change at all.

Keywords: Spectroscopic ellipsometry, DNA, bio-sensors

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[2] I. Solano et al., Investigating organic multilayers by spectroscopic ellipsometry: specific and non-specific interactions of polyhistidine with NTA self-assembled monolayers, Beilstein J. Nanotechnol. 2016, 7, 544–553.