

Electro(de)wetting with Photoswitches: Control of wetting by electric fields and light

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Electro-dewetting (EDeW) was introduced as a new method in order to change the wetting properties of surfaces. Using ionic surfactants such as dodecyl tetrethyl ammonium bromide (DTAB) the wettability of hydrophilic silicon oxides on a a conductive Si substrate can be controlled by an applied electro potential, which leads to an increase in the contact angle. This behavior critically depends on the pH of the aqueous solution, the surfactant concentration and the potential used to drive EDeW. [1] The underlying mechanism is, however, not fully understood and additional experiments are needed.

In this contribution, we report on EDeW experiments using classical DTAB surfactants which confirm previous results [1], while we also report on the application of new cationic photoswitchable surfactants namely azobenzene triethylammonium bromide (Azo-TB) [2], arylazopyrazole triethylammonium bromide (AAP-TB) [2] and butyl-arylazopyrazole triethylammonium bromide (butyl-AAP-TB) for EDeW. These photoswitches can undergo E/Z photoisomerization reactions that cause drastically changes in surface activity [2,3] and offer the possibility to change the contact angle through light irradiation and to fine tune the EDeW ability of these systems. In previous work, [1] it was suggested that surfactants are deposited on the silicon oxide surface through the EDeW process. In order to study the suggested deposition of surfactants and the role of a possible prewetting layer outside of the contact line as a function of applied potential we have performed vibrational sum-frequency generation (SFG), which we combine with contact angle goniometry and ellipsometry, which are done in separate experiments. Ellipsometry is applied to monitor the thickness changes outside the drop at some distance from the 3-phase contact line and related to the results from vibrational SFG spectroscopy.

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