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Characterization of buried interfaces of polymer films using high kinetic energy photoemission

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We have characterized the buried interfaces of oxidized PS-OH layers grafted on silicon substrates with high kinetic energy photoemission at the BESSY II HIKE endstation (Helmholtz-Zentrum Berlin für Materialien und Energie). PS-OH layers (4.7 nm thick) have been prepared by spin-coating and oxidized using gold-coated PDMS stamps, replicating DVD patterns. The oxidation was achieved by applying a 35-40 V bias voltage at relative humidities above 70%. The figure shows the Si1s photoemission lines taken with photons in the 2020-3000 eV range. At 2020 eV (black continuous line) only the feature associated to sub-stoichiometric silicon oxide (SiOx) is detected, which builds the interface with the grafted polymer. At increasingly higher photon energies, first the stoichiometric oxide (SiO2) and then the silicon substrate are observed. We thus observe that the PS-OH/SiOx, SiOx/SiO2 and SiO2/Si interfaces can be selectively approached by tuning the electron kinetic energies and thus the electron mean free paths. Surprisingly, the PS-OH layer is not oxidized in this process as clearly observed from the C1s signal.

Caption (s) - Add figures as attached files (2 fig. max)

Si1s photoemission lines taken at 2020, 2100, 2300, 2500 and 3000 eV photon energies. The binding energy regions corresponding to the bare silicon, stoichiometric silicon oxide (SiO2) and non-stoichiometric silicon oxide (SiOx) are indicated.

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