

Photoelectron Spectroscopy Studies of PTCDI–C₈ Thin Films Growth on Si(100) and Si(110)

K. Lament, M. Grodzicki, W. Kamiński, P. Mazur, A. Ciszewski

Institute of Experimental Physics, University of Wrocław, Pl. M. Borna 9, Wrocław, 50-204, Poland

Electronic and physicochemical properties of molecular films on semiconducting substrates depend on growth mechanism and film morphology. Studies on evolution of the interface formation with increasing coverage are particularly needful in order of better understanding the mechanisms that control final properties of the film. Herein we report results obtained by using X-Ray Photoelectron Spectroscopy (XPS), Ultraviolet Photoelectron Spectroscopy (UPS) and Density Functional Theory calculations (DFT) for adsorption studies of PTCDI–C₈ on Si(100) and Si(110) surfaces. For first stages of the film growth, when the molecules adsorb directly on the surface, formation of specific O–Si bonds is detected by XPS for both studied surfaces. Formation of such bounds is also confirmed by DFT calculations. It gives evidence for strong molecule–substrate interaction. UPS results show that the work function increases following the film growth for both surfaces. The HOMO and HOMO -1 states are well pronounced on the UPS spectra. They shift with the increase of the molecular layer thickness. It indicates growing influence of intermolecular bounds on the electronic properties of the adsorption layers on both substrates. Although this bounds promote molecular self-organisation, the long-range order was not observed for the studied films of the thickness amounted up to 6 nm. It leads to the conclusion that for such films their morphology is dominated by the adsorbate-substrate interactions.