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TOF-SIMS CHARACTERIZATION OF POLYMER THIN FILMS: IMPACT OF MOLECULAR WEIGHT

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Organic materials have risen to great importance in the world of electronics. Especially polymers have brought new possibilities to the field. With their numerous advantages like thermal stability, etch resistance and flexibility, organic compounds are growingly being studied and used for conductive layers, high resolution lithographic and packaging applications. In order to understand the logic behind the development and selection of such materials, it is fundamental to acquire a basic familiarity with the relationships between their structural parameters and physicochemical properties. Chemical depth profiling techniques like time-of-flight secondary ion mass spectrometry (ToF-SIMS) can help identify the relationship between the polymer chemical behavior when being bombarded by primary ions and their structural parameters. In this work, we present the characterization of poly (methyl methacrylate) and polystyrene thin films with varying molecular weights (2-9.9x10^5 g.mol^{-1}) by ToF-SIMS measurements. It focuses on the in-depth investigation of the influence of the molecular weight of the mentioned polymers on the efficiency of the sputtering process, at different energies. The characterization was carried out using monoatomic cesium sources with different energies for sputtering and bismuth ion sources for analysis. Additionally, roughness measurement using atomic force microscopy (AFM) was performed because the surface topographic change during sputtering is known to be one of the most important factors to affect depth resolution. The experiments show an inversely proportional relationship, with different orders of magnitude, between the sputtering yield volume (nm3/primary ion) and the molecular weight Mw. This tendency can be related whether to the studied polymers glass transition temperature (Tg) or to the initial solution viscosity.

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