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TOF-SIMS DEPTH PROFILING OF LINEAR AND CROSS-LINKED METHACRYLATE POLYMERS THIN FILMS USING MONOATOMIC ION SPUTTERING

► NSN / NANOMETER STRUCTURES & NANOTECHNOLOGY

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Abstract content

Owing to their specific physical properties, polymeric materials are increasingly used in the field of nanotechnologies, for instance for nano-impression, lithography or organic light emitting diodes applications. These properties are largely controlled by polymer structural parameters such as molecular weight, polydispersity or crosslinking density.... It is then desirable to have characterisation technique able to provide structural information at the nanometer scale. Considering its intrinsic properties, Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS) appears particularly adapted to this purpose. It is then more and more used to investigate structures and chemical composition of polymers developed for nanotechnologies applications [1]. Specifically, low energy caesium sputtering appeared to be a successful path to depth profiling of polymer, providing a reliable chemical information weakly affected by damages generated by the energetic interactions between ions and the organic samples [2].

In this work, we will examine the ToF SIMS depth profiling, using monoatomic caesium ion beam for sputtering, of methacrylate thin film polymers with diverse structural properties. Two kind of nanometric layers coated on silicon wafers are studied: on one hand several molecular weight poly(methyl methacrylate) (PMMA); on another hand a hydroxy-ethyle (HEMA) / methyl methacrylate (MMA) copolymer cross-linked at different levels.

Dual beam depth profiling has been performed on a ToF-SIMS 5 instrument (from IONTOF GmbH). The analysis is performed using a 15kV Bi₃⁺ beam while the sputtering is performed with a Cs beam, energized between 2 keV and 250 eV. The results of these interactions are examined in terms of sputtering yield Y , which is the volume sputtered by each individual primary ion. The effects of structural parameters of polymers on Y will be then discussed considering polymers properties such as glass transition temperature T_g , especially for linear PMMA whose variations of Y has been measured at different temperature around T_g .

References

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[2]. Houssiau L et al. Applied Surface Science, 2008;
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