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ABSTRACT SUBMISSION

Title: Investigation of nanomechancial and nanotribological behaviour of glassy polymers after low energy ion irradiation

Abstract No.	0394
Title	Investigation of nanomechancial and nanotribological behaviour of glassy polymers after low energy ion irradiation
Abstract	*ICASS_2019_J_Zekonyte.doc*
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Text Abstract	Polymer modifications via low energy ion, plasma or corona discharge induce various changes in surface chemical, physical and mechanical properties, leaving polymer bulk unchanged. However, not all induced changes affect polymer response equally and with the same outcome. Here, we investigated tribological and mechanical properties of polystyrene (PS) and polymethylmechacrylate (PMMA) at the nanoscale, after both polymers were subjected to low energy Argon ion irradiation. Thin polymer films prepared by spin-coating were irradiated with 1.5 keV Ar ions in the ultrahigh vacuum chamber at different times. The changes in polymer chemistry were evaluated using X-ray photoelectron spectroscopy. Nanomechanical measurements were performed using atomic force microscopy (AFM) in spectroscopy mode, and tribological responses were investigated using lateral force microscopy. Both measurements were performed in an ambient atmosphere. Ion interaction with polymer surfaces causes bond breakage, removal of small molecules, creation of cross-links and low molecular weight species. All this occurs simultaneously, but with different yield. During the ion irradiation, PS preferentially forms cross-links, while PMMA surfaces are enriched with small molecules. This, as a result, affect the mechanical and tribological properties of polymer surfaces. Measured friction properties for both PS and PMMA decreased with the treatment time. However, the improvement in wear resistance observed for PS was not achieved for PMMA. Polystyrene becomes harder and more wear resistant through the formation of strong cross-linking networks, and reduction in friction is achieved via the creation of carbon rich layers after the irradiation. Polymethylmethacrylate "softens" after the irradiation allowing short chains to be easily moved around which also may act as lubricating molecules reducing friction.
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