Stopping and Range Ions in Matter (SRIM Simulation) as Important Computational Tool for discuss the Plasma Immersion Ion Implantation on Polymer targets

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Abstract

The goals of this work were presented by two contents:

(i) Introduce the physico-chemical surface properties of three commercial polymers (white PVC, PET from coke bottles 2L. and LDPE from Dow Company) as results of Plasma Immersion Ion Implantation (PIII), using SF_6 and N_2 plasmas at low pressure vacuum system. The experiments were conducted in the Technological Plasmas Laboratory (LapTec) between 2011 and 2013. For comparison.

(ii) It was used SRIM/TRIM calculations/Monte Carlo code to access the following output data: ion range and distribution (screening a Gaussian histogram); number of backscattered ions n_B; and vacancies produced n_V according kinchen-Pease formalism. In the two approaches (experimental and simulated), it was used as inputting data: the main ion implantation parameter: -1000 V of high voltage negative pulses in PIII experiments which is matched to 1keV of input energy data in the virtual SRIM environment using F+ and N+ as projectiles ions, and rigid PVC, PET *mylar* and LDPE *marlex* as targets. The purpose is to link, the surface properties of the polymeric samples obtained in laboratory (LapTec) by PIII technique: Θ; $\Theta(t)$; R(z); T(λ) and B (by WVTR) with the output data about ion ranges and distribution, provided by the SRIM Simulation. In addition, parameters of energy loss (eV/angstrom) by ionization, vacancy and phonons were collected.

Images

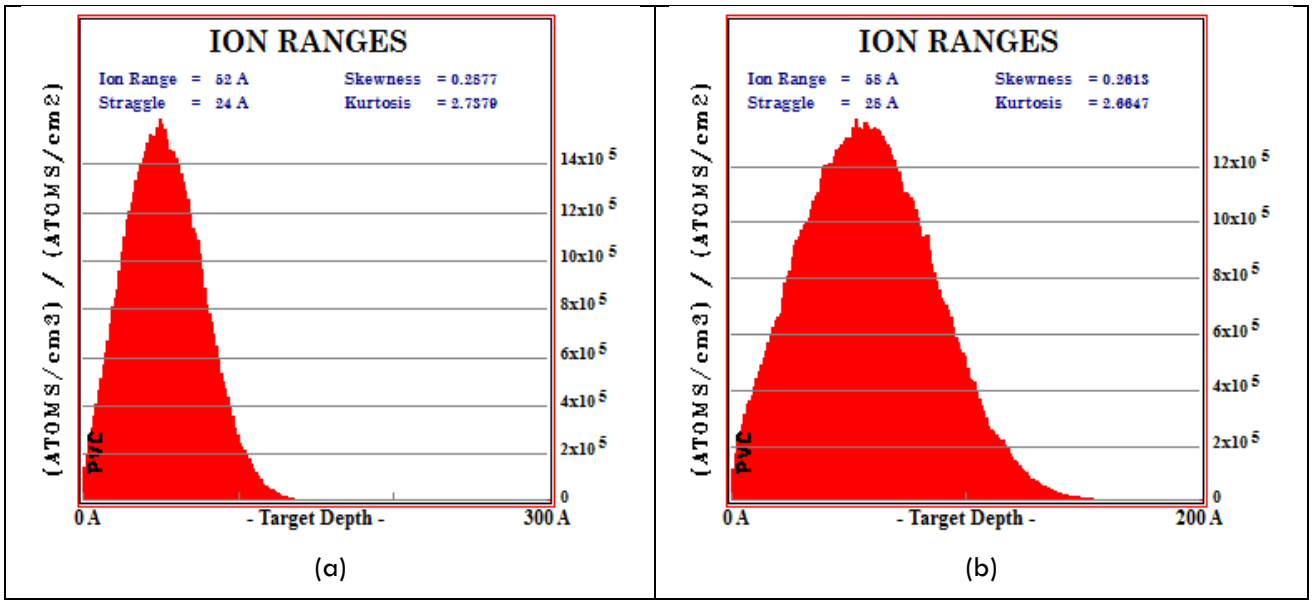


Figure 1: (a) Depth (Angstroms) of incident ions (F+) for the PVC, using incident energy of 1 keV; (b) Depth (Angstroms) of incident ions (N +) for the PVC, using incident energy of 1 keV. The histogram shows the range of values average and maximum.

Recent Publications

1. SANT'ANA P. L.; BORTOLETO, J. R. R. ; Nilson C. Cruz ; Elidiane C. Rangel ; S.F. Durrant ; Botti L. C. M. ; Anjos C. A. R. ; Medeiros E. A. A. ; Soares, N. F. F. ; Azevedo S. ; Teixeira V. ; Carneiro, J. ; Silva C I . Surface Properties and Morphology of PET Treated by Plasma Immersion Ion Implantation for Food Packaging. Nanomedicine & Nanotechnology Open Access, v. 3, pp. 1-13, (2018).
2. SANT'ANA P. L.; BORTOLETO, J. R. R. ; Elidiane C. Rangel ; Nilson C. Cruz ; S.F. Durrant ; Botti L. C. M. ; dos Anjos, C. R. ; Teixeira V. ; Azevedo S. ; Silva C I ; Soares, N. F. F. ; Medeiros E. A. A. Surface Properties of PET Polymer Treated by Plasma Immersion Techniques for Food Packaging. International Journal of Nano Research, v. 1, pp. 33-41, (2018).
3. SANT'ANA P.L et al. Study of Wettability and Optical Transparency of PET Polymer modified by Plasma Immersion Ion Implantation techniques. Revista Brasileira de Aplicações de Vácuo, v. 36, (2), pp. 68-74, (2017).
4. SANT'ANA P. L. et. Al. Study of a-C:H thin films grown by PIII in different times for mechanical and Tribological applications. Revista Brasileira de Aplicações de Vácuo, Vol. 36, (2), pp. 52-58, (2017).
5. Tiago Fiorini Silva; Marcos V Moro, Gustavo T Ferraz, Nemitala Added, Manfredo H Tabacniks, Ronaldo J Santos, Péricles L Sant'Ana, José Roberto R Bortoleto. Ion beam analysis of a-C:H films on alloy steel substrate. Thin Solid Films 545, pp. 171–175, (2013).



Biography

Péricles Lopes Sant'Ana is Production Engineering (Federal University of Viçosa, Minas Gerais State, Brazil – 2007), Master and Doctor in Materials Science and Technology (State University of Sao Paulo, Brazil). He has 10 years in Research and Development, working with Plasma Surface Treatment and Thin Films Deposition for Food Packaging and Optical Devices. Recently he developed PVC, PET and LDPE polymers using Plasma Immersion Techniques, reaching good surface properties combination of Wetting, Roughness, Optical Transmittance and Barrier Properties, in which are useful for Biotechnology, Food Packaging, Sensors and Devices, Medicine and others important applications.

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