ULTRAVIOLET AND OZONE DEGRADATION OF P3OT FILMS STUDIED BY SCANNING PROBE MICROSCOPY

J. Abad[1], B. Pérez-Garcia[1], E. Palacios-Lidón[2], A. Urbina[2] and J. Colchero[1]

[1] Dep. Física, Centro de Investigación en Óptica y Nanofísica-CIOyN (Campus Espinardo), Universidad de Murcia, 30100 Murcia, Spain
[2]Dep. de Electrónica, Universidad Politécnica de Cartagena, 30202 Cartagena, Spain
jabad@um.es

Resumen

The use of thin films composed of π-conjugated polymers has attracted much attention in recent years due to their potential applications in (opto)electronic devices such as thin film transistors, light-emitting diodes, and in particular plastic solar cells [1]. In the field of organic solar cells the power conversion efficiency and the durability are issues that have to be addressed in order to make this technology competitive with traditional silicon solar cells. One of the research lines of our group is devoted to a better understanding of how the nanoscale properties determine the macroscopic behaviour of such devices [2,3,4]. Among the π-conjugated polymers poly-(3-octylthiophene) (P3OT) is one of the most promising materials for applications in these organic opto-electronic devices [5].

To study the durability of plastic solar cells, in the present work we investigate the modification of thin P3OT films by ultraviolet (UV) radiation and ozone degradation. We have prepared films of 50-200 nm thickness by spin-coating on conducting as well as glass substrates. The samples were characterized by different non-contact Scanning Force Microscopy (SFM) techniques, in particular Kelvin Probe Microscopy and local conductivity imaging, as well as by macroscopic electronic transport measurements. Our experimental setup allows us to perform SFM studies of the same area even if the sample is taken out of the SFM system for different processes (UV exposure and sputtering) or macroscopic measurements. This allows powerful correlation studies between nanoscale structure and macroscopic measurements. Our results can contribute to explain the degradation mechanism of the devices when exposed to solar light. The observed nanoscale structural changes are correlated on the one hand with changes of the macroscopic transport properties and on the other hand with the optical absorption of the samples, and thus finally with the overall performance of the fabricated devices.

Referencias:

[1] C. J. Brabec *et al.* Adv. Funct. Mater. **11** (2001) 15.
[2] E. Palacios-Lidón *et al.* Adv. Funct. Mat. **16** (2006) 1975.
[3] B. Pérez-García *et al.* Nanotechnology **19** (2008) 065709.
[4] J. Abad *et al.* European Polymer Journal (2008) in press.
[5] R. Singh *et al.* Polymer **46** (2005) 9126.

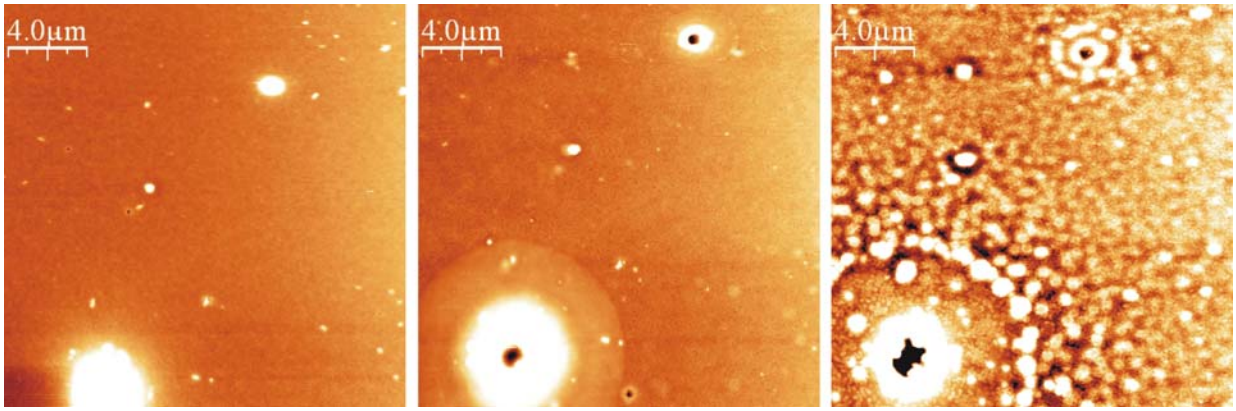

Figure: Topographic images of P3OT thin films UV irradiated. Left figure: Pristine sample. Middle figure: 10 minutes of UV irradiation. Right figure: 30 minutes of UV irradiation.