P3OT SURFACE CHARACTERITATION AS A FUNCTION OF TEMPERATURE BY VARIABLE TEMPERATURE SCANNING FORCE MICROSCOPY.

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The study of π-conjugated polymers plays an important role nowdays due to their different aplication in (opto)electronic devices, plastic solar cells[1], light emision diodes[2], etc. It is well known that polymers present a very rich molecular dynamic at temperatures raging between 0 and 100^0C such as crystalline phase transition, glass transition and melting. Therefore the study of these phenomena as a function of temperature is of vital importance. In addition, Scanning Force Microscopy (SFM) techniques have shown to be powerful tools for determining the polymer mechanical properties in the nanoscale.

In this work we study the dependence of topography and mechanical properties as a function of temperature in different crystalline and amorphous phases in the poly(3-octylthiophene) (P3OT), thin films[3] by variable temperature SFM. By ranging the temperature between 5^0C and 115^0C, the topograpy images (Fig.1,2) show that the crystalline regions disappear and all the polymer become amorphous. In parallel, local force spectroscopy has been performed at each temperature to determine the variation of stiffness of the two phases. It has been found that in both phases stiffness decreases with temperature increase, reaching a minimum at the phase transition temperature (Fig. 3).

References:

[1] Brabec C J, Sariciftci N S and Hummelen J C, Adv. Funct. Mater,. **11** (2001) 15

[2] Friend R H *et al.* Nature **397** (1999) 121

[3] Abad, J. Pérez-García, B**.** Urbina, A. Colchero, J. and Palacios-Lidón, E. , European Polymer Journal**,** *in press.*

Figures:

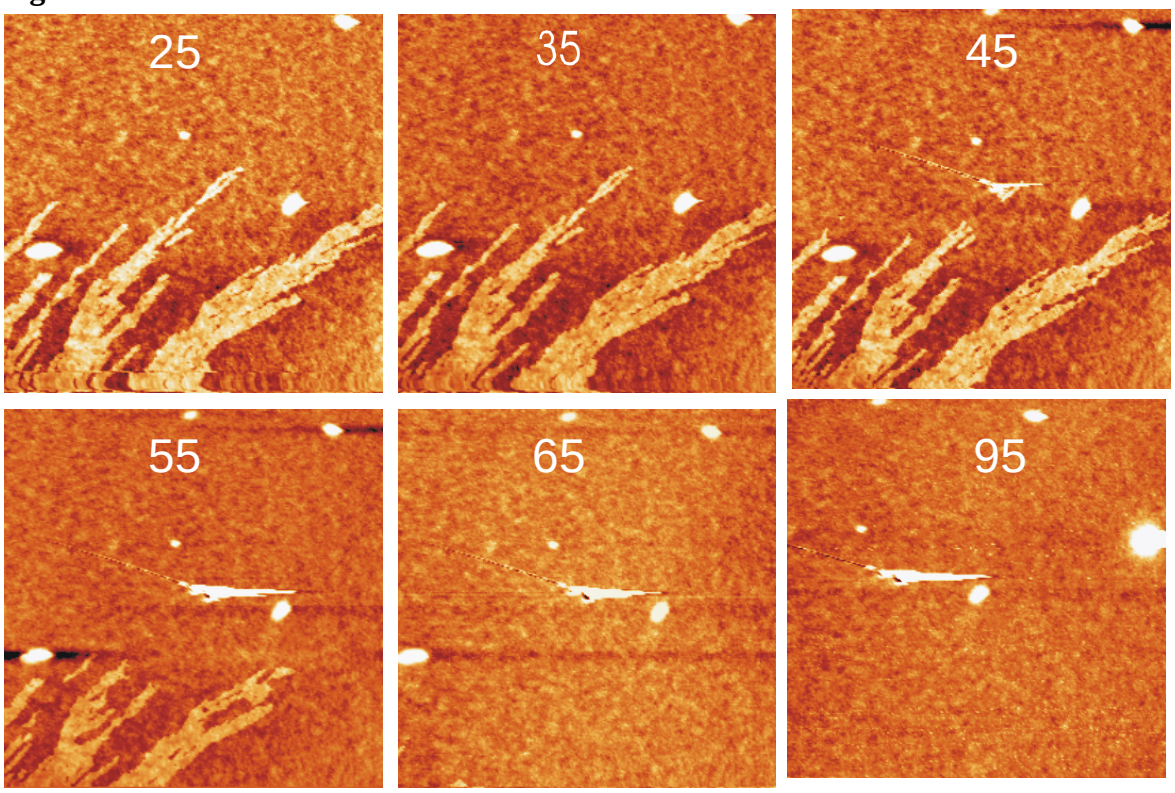

Figure 1. P3OT topography images (11.5 μm^2) in an increasing range of temperatures between 25ºC and 95ºC. Crystalline phase (brighter zones) disappears when temperature increases.

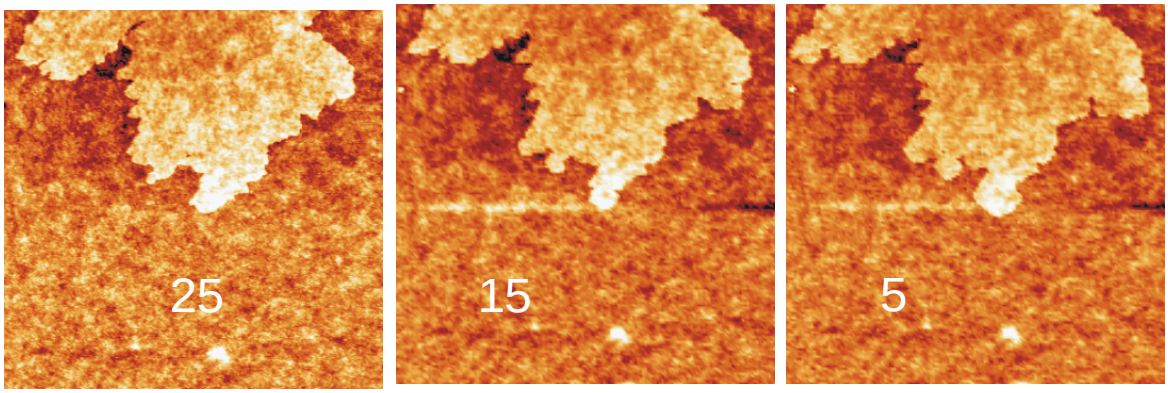

Figure 2. P3OT topography images (7.2 μm^2 **)** in a decreasing range of temperatures between 25ºC and 5ºC). Crystalline phase (brighter zones) increases when temperatue decreases.

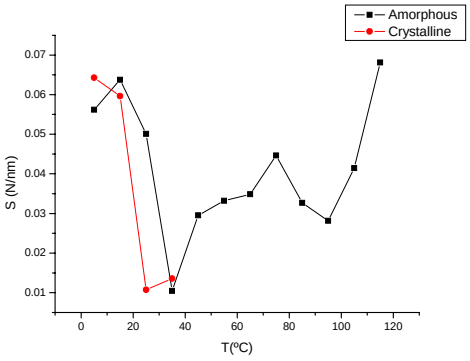

Figure 3. Stiffness determination as a fuction of temperature by local spectroscopy mearurements.