

## Abstract

The effect of physical ageing process on the electrical and thermal properties of amorphous and semi-crystalline PEN was investigated by means of the thermally stimulated depolarization currents (TSDC) and the differential scanning calorimetry (DSC). The TSDC measurements revealed a significant decrease in the mobility of the molecular chains in the amorphous PEN (PENa), aged at a temperature  $T_g - 10K$  ( $T_g$  is the glass transition temperature). This mobility is directly related to the polarisation corresponding to the main relaxation of the material. This phenomenon was also observed in the case of biaxially stretched PEN (PENbiax). However, it is much less important in this case. The calorimetric technique (DSC) showed, in the case of PENa, that the effect of ageing is particularly important when the ageing time increases with a maximum effect for ageing temperature equal to  $T_g - 10K$ . In the other side, no effect was observed on the semi crystalline PENbiax by the DSC technique unlike the TSDC technique. These results confirm again the high resolving power of this latter. Also, the effect of crystallinity on the structural relaxation of PEN was highlighted and is summarized as following : firstly, we have observed a decrease in the TSDC peak's intensity of the alpha-relaxation and in the recovery enthalpy of the structural relaxation when the crystallinity rate increases. Secondly, an increase in the activation energy  $\Delta h^*$  with the increase in the crystallinity rate and a decrease in the limit fictive temperature  $T'(f)$  were observed.