Investigation of initial stage of chemical etching of ion tracks in polycarbonate

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Chemical track etching and the growth of nanochannels in ion-irradiated polycarbonate foils were investigated by loss of weight measurements and IR-spectroscopy. The data provided by both methods are in good agreement and allow us to shed light on the early stage of pore formation including times where the breakthrough of the pores has not yet occurred. Clear evidence is shown that the pore growth as a function of etching time depends on the irradiation fluence. For fixed etching parameters, foils containing 7×10^9 tracks/cm^2 exhibit much smaller pores than samples with 2×10^8 tracks/cm^2. This effect is independent of the etching temperature and appears for irradiations with Pb ions as well as for Ca–ion tracks sensitized by UV exposure. Model calculations for different etching times and fluences show that the data for low track densities can be fitted quite well by describing the radial etching rate by the track etch rate changing into the bulk etch rate with a Gaussian-shaped transition.