

The effects of different radiation sterilization modalities on some different Medical grades of Polypropylene

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Polypropylene (PP) is a major polymer for the medical industry. Irradiation of PP can induce several physical changes including embrittlement, stiffening, yellowing and decrease of molecular weight [1,2]. X-ray is an emerging technology as a radiation sterilization modality.

Some commercial medical grades of PP are claimed to be radio-tolerant but their comparative study under radiation including electron beam (EB), gamma irradiation and particularly new X-ray is not investigated through research.

We have investigated 3 of them with the 3 mentioned radiation modalities in the frame of the Coordinated Research Project (CRP) n F23035, led by IAEA.

We have used different laboratory testing techniques to characterize physico-chemical, mechanical and thermomechanical properties of the material, at molecular and macromolecular levels.

We have been able to establish the behaviour of the materials with the dose and in correlation with the dose rate, as it was maintained at a standard processing level typical to each irradiation modality. As a first example to underline the interest of our study, the figure 1 hereafter shows the different evolution of the 3 studied grades (references will be given later) with the dose and the radiation modality. We will discuss these results with some other analyses, among them there are rheology and colorimetry.

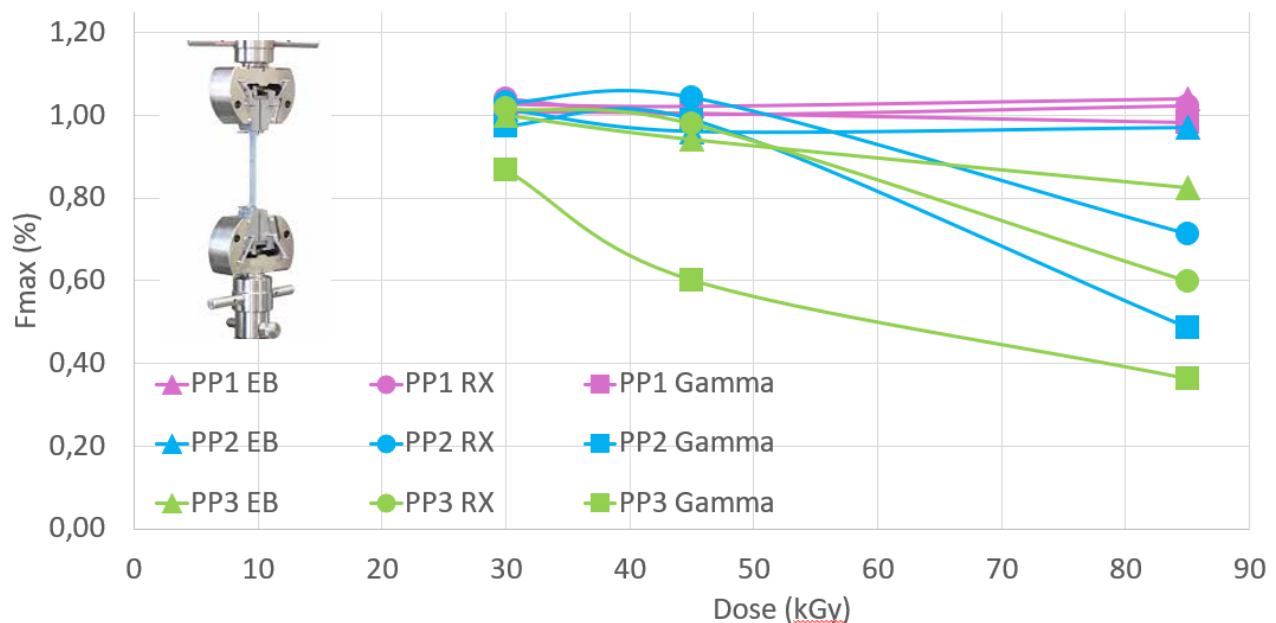


Figure 1 : Relative values of maximum force during tensile test of the 3 grades of PP, non-irradiated (NI) and treated with the 3 different modalities (EB, gamma, RX), at different doses

References:

- [1] E. A. Hegazy, T. Seguchi, K. Arakawa and S. Machi. J. Appl. Pol. Sci. 26 (1981) 1361-1372
- [2] Chap 6 : Commodity Thermoplastics : Polivynil Chlorid, Polyolefins and Polystyrene in Plastics