

# Polypropylene films grafted with styrene using PCBTF as solvent

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In this study, radiation-induced grafting of styrene (S) onto polypropylene (PP) 0.1  $\mu\text{m}$  thickness was investigated with respect to: the effect of irradiation dose (40 and 80 kGy); reaction time of post simultaneous irradiation process (7 and 15 days) and using 4-chlorobenzotrifluoride (PCBTF) as solvent. PCBTF is potentially useful for organic and fluorine synthesis. Despite these favorable characteristics, PCBTF is unknown as solvent for polymer modification using radiation. The ratio of monomer:solvent, S:PCBTF, used was 4:1 (v/v). The degree of grafting (DOG) was obtained gravimetrically by measuring the weight of the film before and after the radiation-induced grafting at post simultaneous irradiation using the following equation:

$$\text{DOG (\%)} = [(W_g - W_o)/W_o] \times 100$$

Where  $W_g$  and  $W_o$  are the weights of the grafted and original PP film, respectively.

The behavior of styrene grafting was found to be very similar for both reaction times. However, the DOG obtained at 80 kGy was higher than 40 kGy. This result can be attributed to the fact that the increase in the radiation dose leads to generation of more radicals in the grafting system, consequently, more radicals contribute to the grafting reaction, table 1. The thermogravimetric (TGA) curves for grafted PP films showed that the mass loss begins at low temperatures (25°C) reaching the total of ~100% mass loss at about 600 °C. Two stages can be considered. The first ranges from 25 to about 100 °C that corresponds at about 1% weight loss assigned to water molecules. The second stage, 350 – 500 °C, gives about 98% weight loss, corresponding to PP grafted decomposition. The DSC thermogram of original PP shows a strong transition (endothermic peak) at 162 °C which corresponds to the melting temperature ( $T_m$ ). The incorporation of styrene onto PP film does not change significantly  $T_m$  value, for example, the modified film with 80 kGy after 15 days of reaction shows  $T_m$  in 163 °C. By means of the FT-IR it was observed that the monomer was grafted into the PP film.

Table 1- Variation of the DOG (%) with the dose and reaction time

Dose (kGy)	DOG (%)	
	Reaction time (days)	
	7	15
40	29.2	30.0
80	44.0	45.9

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