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STRUCTURE EVOLUTION DURING DEFORMATION OF NOVEL POLYMER SYSTEMS BASED ON POLY(ETHYLENE TEREPHTHALATE) REINFORCED WITH INORGANIC PARTICLES

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Inorganic particles have been incorporated into poly(ethylene terephthalate), PET, matrix with the aim of offering some aesthetic effects to the standard transparent beverage packaging. To assess to the effect of different type of inorganic particles (with different interaction with the polymeric matrix) in the deformation behaviour of PET composites, particles such as aluminium, bronze, nanoclay, graphite and mica, were used. Two types of processing methods, ensuring a good mixing, were adopted for the composite preparation: i) melt-blending in an asymmetric batch mini-mixer followed by compression and ii) melt-blending in a twin screw extruder followed by injection moulding. The structural and mechanical behaviours of neat PET and its composites were evaluated during uniaxial stretching at temperatures above the glass transition temperature, Tg, namely at 85, 90, 95, 100 ºC, using a standard tensile stretching machine equipped with an environmental chamber. This study aims at understanding the deformation behaviour of the materials at temperatures found in conventional transformation methods used for packaging. To interpret the structural evolution occurring in the samples, off-line techniques such as DSC, WAXD and SEM were used. A detailed structural evolution was accomplished by applying different stretching ratios to the samples up to a maximum of 5x. Injection moulded samples were also characterized for their mechanical properties at room temperature in order to assess the materials behaviour in service.

From all particles studied the PET/Aluminium and PET/Bronze composites are the ones showing the best combination of aesthetic effects, deformation behaviour and final mechanical properties. Comparing to neat PET, their general properties are the same during the deformation process making the new materials suitable for conventional processing techniques. It was found that both particles offer superior molecular mobility to PET at room temperature. In other words, these composites present a higher deformation capacity, however its elastic modulus and tensile strength at yield are slightly reduced.

Keywords: PET composites; inorganic particles; deformation mechanisms; packaging application.