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PP-CLAY NANOCOMPOSITES: DEGRADATION AND STABILISATION

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This paper highlights the deleterious effects of clay nanofillers on the thermo- and photo- oxidative stabilities of polymer nanocomposites (PNCs). The effects of processing and the environment on the oxidative degradation and performance of polymer products are well documented but very little is available in the open literature on the long term performance characteristics of products based on PNCs. It is generally recognised that the presence of a few percent by weight of clay nanofillers in PNCs can offer significant advantages in terms of barrier properties, fire retardancy and mechanical properties. However, in polyolefin-based nanocomposites, these nanofillers account for a considerable degree of instability and loss of long term performance properties. The incorporation of inorganic-based clays in hydrophobic polymer resins, such as polypropylene (PP), to produce an organic-inorganic hybrid materials presents many challenges due to a range of physical (nanofiller dispersion, distribution and migration) and chemical (thermo- and photo- oxidative stability of the matrix, the organically modified clay and the compatibiliser) factors that are responsible for a marked drop in their durability and lifetime performance. It is often found that the same nanofiller properties that appear to enhance the mechanical properties of a polymer nanocomposite would concomitantly reduce their stability toward heat and light. The effects of the nanofiller and the compatibiliser on the oxidative degradation of PP-clay nanocomposites during melt processing and ageing will be discussed along with stabilisation strategies for enhancing durability and for optimizing their long-term performance. Several advanced analytical tools were employed to better understand the underlying chemistry of degradation and stabilisation of PPNCs.