Environmental Aging of Polymer Nanocomposites and their Characterization

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Abstract

Polymer is a ubiquitous material around the world. Different types of polymers such as polypropylene, polystyrene, polyethylene, polyurethane, and epoxy, known as plastic, are widely used in various purposes due to their cost-effectiveness and ease of applications. In many cases, various additives, including UV blocking reagents, flame retardants, pigments, moisturizers, and nanomaterials, were widely utilized to improve different polymers' original properties for different purposes in polymer industry. Therefore, polymer composites are extensively used in various industries such as food packages, sport goods, household goods and transportation.

Due to a massive amount of the use of plastic composites, they could enter into the environment in the middle and/or end of their life cycle and thus, we have faced to worldwide plastic problems such as plastic wastes and pollutions, including plastic islands in the ocean and the formation of microplastics in the environment. Usually, plastics in the environment are exposed to environmental aging such as photo-oxidation by solar light and chemical oxidation by reactive oxygen species generated in the environment. As a result, chemical additives, nanomaterials and microplastics in the polymer composites could be released into the environment during the environmental aging. Therefore, it is important to make much effort in the environmental

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engineering for understanding the environmental aging of polymer nanocomposites and their characterization.

In this study, different polymer nanocomposites were used and aged in an accelerated environmental aging chamber, which can simulate different weather conditions. During the aging, physicochemical properties of the polymer nanocomposites were characterized with different techniques of scanning electron microscopy, Fourier-transform infrared spectroscopy, thermogravimetric analysis and differential scanning calorimetry Analysis. Also, the release of nano-additives and microplastics was investigated with transmission electron microscopy.

The results of the environmental aging of the polymer nanocomposites and their characterization along with the release of nano-additives and microplastics from the polymer nanocomposites by the aging will be presented and discussed in detail.

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