CHAPTER 9

Morphology, rheology, properties, and applications of fullerene-filled polymer blends

Rasidi Roslan[1,2] and Mohd Hasbi Ab. Rahim[1,2]
[1]Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang Al-Sultan Abdullah, Lebuh Persiaran Tun Khalil Yaakob, Gambang Kuantan, Pahang, Malaysia
[2]Centre for Advanced Intelligent Materials, Universiti Malaysia Pahang Al-Sultan Abdullah, Lebuh Persiaran Tun Khalil Yaakob, Gambang Kuantan, Pahang, Malaysia

Abstract

In the last three decades, the utilization of fullerene's unique structure and characteristics rose steeply with interest from industries and academia. Numerous new fullerene derivatives have been developed, particularly involving fullerene incorporation into a polymer matrix. In this chapter, the essential properties for fullerene–polymer nanocomposites (fullerene-PNCs), which are morphology, rheology, mechanical, and thermal, are discussed. The most crucial factor, the morphology that affects the overall polymer performance, was elaborated. This includes the solvent suitability to disperse fullerene in the polymer matrix, the best polymer/fullerene ratio, the phase diagram of a binary polymer/fullerene system, and the effect of the domain size. The impact of fullerene incorporation on the viscosity changes, viscoelastic behavior, tensile strength, or fracture toughness is also discussed. Several applications related to fullerene-PNCs, such as commercial engineering thermoplastic, protective coating, and photovoltaic, are provided. Finally, a summary and outlook of fullerene-PNCs are presented.

Keywords: Fullerene; phase diagram; viscoelastic behavior; mechanical properties; thermal properties

9.1 Introduction

Polymers are compounds produced from several repeating units known as monomers. They can be classified as natural, for example, cellulose, alginate, enzymes, and deoxyribonucleic acid, and synthetic, such as polyethylene, polyester, and polyvinyl chloride [1]. Meanwhile, composites are materials that generally consist of two or more components [2,3]. In polymer composites, the major components (polymer) are known as the matrix, and the minor components play the role of reinforcing material. Polymer composites usually have excellent physical and chemical properties compared to individual components [4,5]. In certain instances, the addition of reinforcing materials will see synergism, where the matrix and reinforcement material complement each other and impart unique characteristics or enhancements to the polymer composites.

Nanofillers for Binary Polymer Blends
DOI: https://doi.org/10.1016/B978-0-323-88655-0.00007-0