ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
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Enhanced Tensile Strength with Sulphuric Treated Short Carbon Fibre

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Keywords: Short carbon fibre, oxidative treatment, tensile strength, surface roughness, interlocking, thermoplastic natural rubber.

Abstract. Synthetic carbon fibres have long been available for various applications. For optimum performance in-service, surface treatment of carbon fibre is essential. This study was undertaken to investigate the effect of short carbon fibre (CF) loading and oxidative treatment employed on the tensile strength of thermoplastic natural rubber (TPNR) composites. Scanning electron micrograph (SEM) revealed the rough surface of sulphuric acid treated carbon fibre. The enhanced surface area of carbon fibre promotes mechanical interlocking between treated carbon fibre and TPNR matrix, thus supporting the increment in tensile strength.

Introduction

In reinforced short carbon fibre, physical properties that include surface area and porosity are important parameters as it determines the extent of the interface in the composite. The surface of untreated carbon fibres can be generally described as smooth. The smooth surface was due to annealing of surface defects and closure of pores at high temperature during production of carbon fibre.

Chemical properties of carbon fibre surface also affect the interface with matrix. The carbon atoms of a carbonaceous material are in hexagonal rings, which are polycondensed and form aromatic carbon lamellae. The structure for aromatic layer and basal planes are imperfect and contains some defects like stacking faults, single and multiple atom vacancies, and dislocation. The carbon atoms, which located at grain boundaries or edges of lamellae are more reactive than the basal plane carbon atoms and contain the active sites. This active site is an important characteristic for carbon reactivity [1].

The interlaminar shear strength of carbon fibre reinforced composites is related to the fibre-matrix interfacial bonding. The bond can be in the form of physical which is due to mechanical interlocking between the fibre-matrix or chemical bonds between the matrix and the active sites on the fibre surface. The active sites are located at the edges of the crystallite basal planes emerging at the surface, structural defects such as vacancies, dislocations or steps in the basal planes oriented parallel to the fibre axis [3]. Mechanical interlocking is determined by fibre surface area, the surface porosity and surface roughness. The fibre surface morphology is dependent on the precursor material where PAN-based fibres exhibited smaller surface area with smooth surface and circular cross section.