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Role of E-glass fiber on mechanical, thermal and electrical properties of polyphenylene sulfide (PPS) composites

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ABSTRACT

The present work focusses on the fabrication and characterization of E-glass fiber reinforced Polyphenylene Sulfide (PPS) composites. The composites were fabricated using compression molding method. The fabricated composites were characterized for mechanical properties such as tensile, flexural, impact properties and thermal properties like heat distortion of neat PPS and glass fiber reinforced composites. The various percentages such as 10, 20, 30 and 40 wt% of glass fiber was added into the PPS matrix to analyse the role of the same on mechanical, thermal and electrical properties. The results exposed that, the PPS composites filled with 30 wt% of glass fiber was found to be optimum in terms of mechanical properties such as tensile, flexural, impact strength and dielectric strength compared to neat PPS and other weight percentages. The Heat Distortion Temperature (HDT) was considerably higher than the neat PPS as a result of the high strength and high glass transition temperature of the glass.

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1. Introduction

In recent years, more research works are having a common objective towards the development of materials, which offers low weight processing high strength, stiffness, dimensional and thermal stability. The composite materials are meeting these requirements; hence, composite materials replace conventional materials. Based on the kind of matrix materials employed, composite materials can be classified as metal matrix, ceramic matrix, and polymer matrix composites. The fiber-reinforced polymer composite materials provide higher strength to weight ratio, stiffness, thermal and tribological properties to the composites which are the most important factors in various engineering applications like automobile, aerospace, space, marine, sports, infrastructure and electrical and electronics industries. The commonly used matrix material for fabricating the polymer composites are epoxy, polyurethane, polyester, polypropylene, polyvinyl butyral [1,2]. The matrix material gives composites toughness, which protects them from harm, as well as corrosion and heat resistance. PPS (polyphenylene sulphide) is a thermoplastic semi-crystalline polymer from the advanced plastics category that is used to make composites [3,4]. Polyphenylene sulfide has low viscosity and considerable fragility, but when mixed with reinforcement materials it exhibits good mechanical, thermal resistance, physical and chemical properties also dimensional stability [5]. PPS-based polymer composites with glass fibre and carbon fibre reinforcement have been carefully investigated for mechanical and tribological characteristics in a variety of applications [6,7]. Natural and synthetic fibers are extensively used in fabricating polymer composites for various applications mentioned above. Synthetic fibers such as carbon, Kevlar, E-glass, etc., are extensively used in fabricating polymer composites which provide high strength and stiffness [8]. Glass fiber-reinforced thermoplastics are used to fabricate the different components in various engineering applications since they provide excellent mechanical properties, low cost and easy processing. The processability and recyclability of Glass-fiber-reinforced thermoplastics make them environmentally friendly [9]. The composites can be fabricated by hand layup, vacuum bagging method, resin infusion technique, filament winding method, compression molding, injection molding, pultrusion method [10].

The aerospace, automotive, electronics, marine, and construction sectors all employ short fibre reinforced polymers. Injection

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