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MECHANICAL PROPERTIES OF COMPOSITE MATERIAL REINFORCED BY CERAMIC FIBER

Abdul Razaq Mohammed

Technical Institute, Babylon, IRAQ.

amam2012449@yahoo.com

ABSTRACT

Mechanical properties of polymeric composite material were studied in this paper. Polyethylene reinforced by ceramic fibers with different weight reinforcement percentage (20%, 40%, 60%) and measuring Impact and tensile strength for resulting composite material. the best results was obtained with large reinforcement percentage (60%) .

Keywords: Composite Material, Mechanical Properties

INTRODUCTION

Polymer matrix composites (PMCs) are comprised of a variety of short or continuous fibers bound together by an organic polymer matrix. Unlike a ceramic matrix composite (CMC), in which the reinforcement is used primarily to improve the fracture toughness, the reinforcement in a PMC provides high strength and stiffness (Dobrzaski, 2006). The PMC is designed so that the mechanical loads to which the structure is subjected in service are supported by the reinforcement (Biron, 2007).

The function of the matrix is to bond the fibers together and to transfer loads between them. Polymer matrix composites are often divided into two categories: reinforced plastics, and advanced composites. The distinction is based on the level of mechanical properties (usually strength and stiffness); however, there is no unambiguous line separating the two. Reinforced plastics, which are relatively inexpensive, typically consist of polyester resins reinforced with low-stiffness glass fibers (Kaw, 2006).

Advanced composites, which have been in use for only about 15 years, primarily in the aerospace industry, have superior strength and stiffness, and are relatively expensive. Advanced composites are the focus of this assessment. Chief among the advantages of PMCs is their light weight coupled with high stiffness and strength along the direction of the reinforcement. This combination is the basis of their usefulness i n aircraft, automobiles, and other moving structures. Other desirable properties include superior corrosion and fatigue resistance compared to metals. Because the matrix decomposes at high temperatures, however, current PMCs are limited to service temperatures below about 316° C (Tong et al, 2002).

EXPERIMENT

Materials

Polyethylene resin and Ceramic fibers.

Samples and Tests

Composite was made by the hand layup technique using laboratory compression molding machine. Three types of samples were manufactured as follows: Impact samples: The impact strength was determined using Charby Impact Instrument conforming to (ASTM-E23)

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specification suitable to Notch depth is (0.5mm) and notch base radius is (0.25mm). Tensile strength samples: The standard dumb bell samples are cast according to (ISO-R-527). Charpy Impact Instrument was used to evaluated the impact strength of composite material .The universal test instrument manufactured by (ZheJinang TuGong Instrument Co., Ltd) was used to measure tensile strength with a (20KN) load .

RESULTS & DISCUSSION

Figure 1 shows the value of impact strength with fibers reinforcing percentage .Generally ,the impact resistance considered low to the resins due to brittleness of these materials ,but after reinforcing it by fibers the impact resistance will be increased because the fibers will carry the maximum part of the impact energy which exposition on the composite material .All this will raise and improved this resistance .The impact resistance will continue to increase with increased of the fibers reinforcing percentage (Dorey et al,1978).

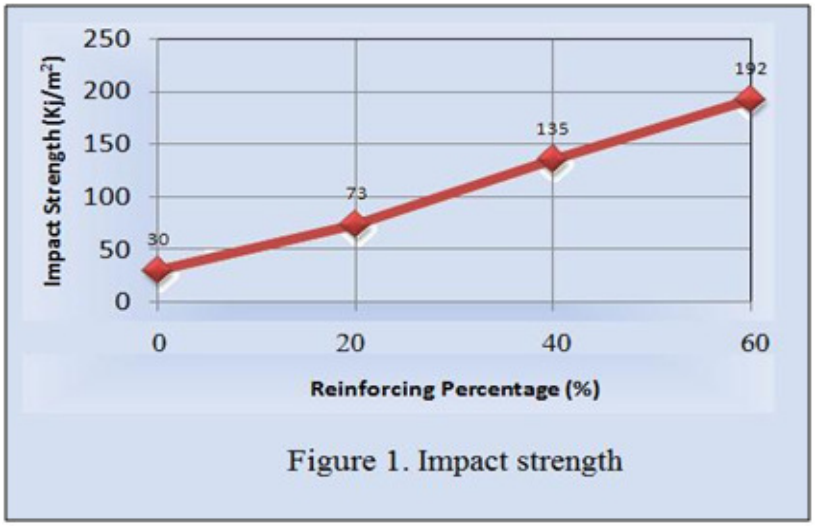

Figure 1. Impact strength

The resin considered as brittle materials where its tensile strength is very low as shown in Figure 2, but after reinforcing by fibers this property will be improved greatly, where the fibers will withstand the maximum part of loads and by consequence will raise the strength of composite material. The tensile strength will be increased as the fibers percentage addition increased, where these fibers will be distributed on large area in the resin (Al-Mosawi, 2009).

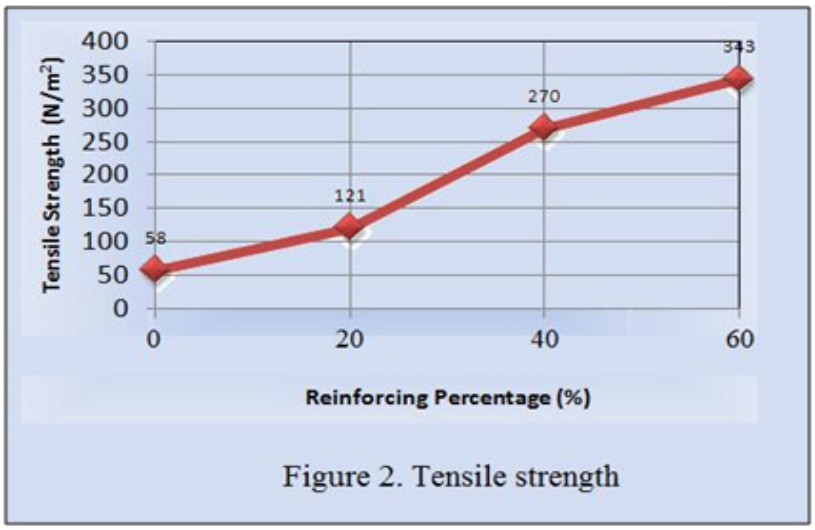

Figure 2. Tensile strength

CONCLUSIONS

From the obtained results we get: Low mechanical properties (Impact, Tensile, and Compressive Strength) of the Polyethylene resin. Enhancement of mechanical properties after reinforcement by ceramic fibers.

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