

PROPERTIES OF POLYSTYRENE RESIN REINFORCED BY CARBON FIBERS

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ABSTRACT

Mechanical properties of the composite material based on polystyrene resin were investigated. Polystyrene resin was reinforced with (0, 15, 30, 45 and 60% by weight wt) carbon fibers. The tensile and impact properties of composites were determined by the tensile and impact tests. The maximum impact strength is (183Kj/m²) at the weight fraction of (60 % wt) of fibers, comparison with (8 Kj/m²) for virgin polystyrene material ,and the maximum tensile strength is (383Mpa) at the weight fraction of (60 % wt) of fibers , comparison with (37Mpa) for virgin polystyrene material.

Keywords: Polystyrene composite, Tensile and impact properties.

INTRODUCTION

Nowadays, composite materials are common materials which are used in industrial usage such as aerospace and parts of industrial mechanical machines. Although the usage of these materials is common amongst mechanical engineers, it is rarely used in building and construction field (Altaweel *et al.*, 2010). A composite is a structural material that consist of two or more constituents that are combined at a macroscopic level and are not soluble in each other. One constituent is called the reinforcing phase and the one in which it is embedded is called the matrix (Dobrzański *et al.*, 2006). The composite material however, generally possesses characteristic properties , such as stiffness ,strength ,weight ,high-temperature performance ,corrosion resistance ,hardness , and conductivity that are not possible with the individual components by themselves (Ayatollahi *et al.*, 2011).

Polymeric composites can be a part of structural element to use in construction fields such as tunneling, pre-cast structure and light structures on water. Some varieties of fibrous materials such as Glass, Aramide, Graphite or Carbon, Polyethylene, Boron and Silicon carbide fiber can be used in polymer materials to improve their tensile and impact strength(Tuttle, 2004).

METHODS AND MATERIALS

Materials

Polystyrene resin as matrix material reinforced by woven roving(0° - 45°) carbon fibers.

Samples Fabrication and Tests

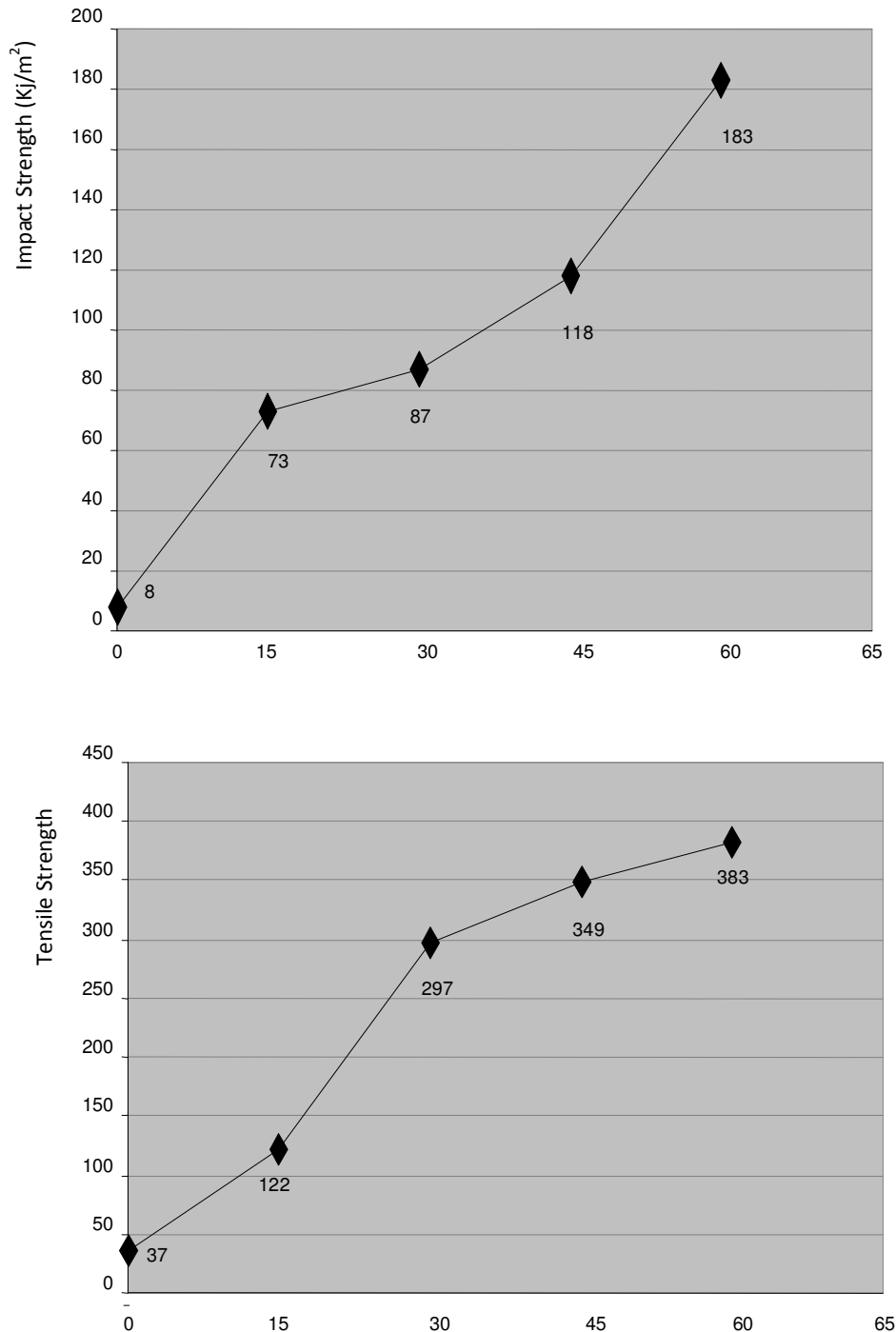
- a- Impact samples: impact samples fabricated according to the (ASTM-E23) standard suitable to Charpy Impact Instrument .Notch depth is (0.5mm) and notch base radius is (0.25mm). Charpy Impact Instrument was used to determine the impact strength of composite material.
- b- Tensile strength samples: these samples manufactured according to the (D638-10) standard. Tensile test was used to calculate the tensile strength of composite material under uniaxial load .The universal test instrument manufactured by (ZheJinang TuGong Instrument Co., Ltd) used to measure this property with a (20KN) load.

RESULTS & DISCUSSION

Fig.1 represent the impact strength value vs. fibers contents .Generally ,the impact strength considered low to the resins due to brittleness of these materials ,but after reinforcing it by fibers the impact strength 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 strength .The impact strength will continue to increase with increased of the fibers reinforcing percentage (Sadeq, 2011).

Figure 2 shows the tensile strength value vs. fibers contents .The resin considered as brittle materials where its tensile strength is very low as shown in this figure ,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 (Rao, 2012).



CONCLUSIONS

1. Impact and tensile properties of polystyrene resin was low.
2. Improvement of mechanical properties after reinforced by carbon fibers , where The maximum impact strength is (183Kj/m²) at the weight fraction of (60 % wt) of fibers, comparison with (8Kj/m²) for virgin polystyrene material ,and The maximum tensile strength is (383Mpa) at the weight fraction of (60 % wt) of fibers , comparison with (37Mpa) for virgin polystyrene material.

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