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Characterization of material properties of green polymer composite

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Abstract

The composite materials are being utilized for many industrial applications. With the advent of academic research, many composite materials are introduced in the market by incorporating bio waste materials. The current paper addresses the tribological behaviour of epoxy composite reinforced with hybrid fibre such as glass and neem along with the incorporation of rice husk ash. The green epoxy composite was prepared using compression moulding by varying neem/glass hybrid fibre ratio between 10 and 40wt% and keeping 2% (by wt.) of rice husk filler as constant. The tribological characteristics was studied through the conduct of pin on disc wear test instrument. Wear resistance of the composite due to the functional parameters such as load, sliding distance and speed were investigated.

Introduction

The composites incorporated with different types of fibres are finding its application in various field like automobile, aerospace, construction and marine industries because of its light weight, high strength, less cost, ease of fabrication and, better

wear, frictional, heat resistance. The epoxy composites are specifically utilized for the manufacture of exterior and interior components like head lamp housing, heat shielding components, panels, frames etc.,. The automotive industry requires a material which has to be light weight along with good mechanical properties. The above said property can only be achieved through the incorporation of fibres into the composite matrix. The availability of different types of fibres makes the researchers to explore and identify the most suitable fibre for different applications. The main advantage of utilizing natural fibres over synthetic fibres are renewable in nature, low in cost, nonabrasive, lightweight, better mechanical properties, high crash absorbance, high flame retardance, biodegradable and naturally re-cyclable [1], [2], [3], [4].

Chen [5] fabricated a bio-composites made from recycled polymers and rice husk fibers (RHF) using compression molding. The fibers were loaded at the rate of 40–80% by weight to study the properties like tensile strength, thermal and water absorption. Gamma radiation was also given to the composite and found that, the incorporation of gamma radiation had increased the tensile strength and dimensional stability of the composite. Dhandapani Kavitha [6] developed a bio composite with inclusion of rice husk in different percentages to study the heat retardant properties. The study includes characterization of chemical structure through Fourier transform infrared spectroscopy FTIR and thermogravimetric analysis TGA. The study revealed that incorporation of rice husk has improved the thermal stability and tensile strength. Christopher Meninno et al [7] conducted experimentation on hybrid natural fibre reinforced laminates with jute and flax fibers. Flexural strength of the specimens were studied through the bending and electrical responses. Along with the natural fibres, carbon nanotubes (multi-walled) were also used in the epoxy matrix. The addition of carbon fibers decreased the flexural strength for most of the cases, however increased the flexural strain at break for all composites of carbon fiber length of 150mm. Agnivesh Kumar Sinha et al. [8] conducted research on epoxy composite fabricated with hybrid natural fibre containing abaca as fibre and red mud as filler. Various parameters such as dosage of fibre/filler, particle size of filler on the wear performance of the composite was established using response surface methodology RSM. Experimental investigation was performed on nine specimens and a validated with fuzzy model with an accuracy of 87%.

The present article focuses on the experimental investigation carried out on epoxy bio composite with different percentages of neem fibre, glass fibre as reinforcement and rice husk as filler material [9], [10], [11]. Pin-on-disc wear test was performed on the fabricated specimens by varying the speed of rotation and the properties were elaborated.

Section snippets

Materials used

The matrix used in this project was epoxy resin (Araldite AW106) along with the hardener (Araldite HV953U). The rice husk, one of the less expensive materials, was used as filler material procured from local industry in Tamil Nadu, India. The filler material was used to reduce the consumption of epoxy resin. Neem and Glass fibres were procured through Vruksha Composites, Andhra Pradesh, India. The fibres were cut to an average length of 5 mm. The various properties such as fibre fineness,…

Wear test

Wear test was performed on the epoxy bio composite at two different speeds such as 150 rpm and 300 rpm, and the values are tabulated in Table 3. There were 9 test specimens with sample ID NG0, NG12, NG22, NG32, NG42, NG14, NG24, NG34, NG44 whereas N denotes neem fibre, G denotes glass fibre, followed by the numbers to denote the percentage of addition of fibres and rice husk ash. For example, NG32 denotes addition of 30% fibre (15% neem fibre, 15% glass fibre) and 2% rice husk ash. From Table 3…

Conclusion

Based on the experimental examination of an epoxy bio composite with varied amounts of neem and glass fibre reinforcement (10%, 20%, 30%, and 40%) and rice husk as filler (2% and 4%), the following results were made. Epoxy becomes a bio composite material when natural neem fibre reinforcement and rice husk filler are added. Weight loss was used to calculate the wear rate. As the proportion of reinforcing and filler material rises, the wear begins to decline. Compared to 2 percent, the wear rate …

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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