ABSTRACT

In recent years, The incorporation of natural fibers as reinforcing agent in polymer composite has gained increasing interest which enhances optimal utilization of natural resources and particularly of renewable resources. Natural fibers have proven to be suitable reinforcement materials for composite; thanks to a combination of good mechanical, high electrical (insulating), impact resistance, good thermal and acoustic insulating properties and with environmental advantages such as renewability and bio-degradability, comparable to synthetic fiber reinforced polymer composites. Hence, for these reasons it has not been surprising that the use of natural materials in the production of composites has gained significant importance both in technical applications such as in automotive industry, as well as in the electronics industry for its dielectric and insulating properties in the use of capacitors, microelectronic components (such as transistors and ICs), and safe insulators for low to moderate voltages (hundreds of volts). In this present research work, we have investigated the dielectrical, mechanical, erosive and abrasive wear behavior of bio-waste (coir dust) reinforced polymer composite.

Dielectric analysis was performed on low density Bio-Waste Coir dust reinforced polymer composites. The dielectric parameters(relative permittivity ε', dielectric loss ε"), dielectric conductivity σ and resistivity ρ of pure epoxy resin and composites with different weight percent of coir dust were obtained in a frequency range of 100 Hz-1 MHz, and temperature range of 30-150° C. The experimental results shows that ε', ε", and σ are increased and ρ is decreased with the addition of coir dust in epoxy resin, and also it observed that the dielectrical properties of the composites showed a strong dependence on testing frequency and temperature. The ε', and ε" increases with increasing temperature because of greater movement of the dipole molecular chains and decreases with increasing frequency due to the orientation polarization. The conductivity of the composite is increased, and the resistivity of composite is decreased with increasing frequency

Experiments are conducted to investigate the erosive and abrasive wear behavior of coir dust filled epoxy resin matrix composites. The effect of coir dust concentration , different impingement angles(30°,45°,60°,75°,and 90°),and various impact velocities(34,48,60,78,and 92m/sec) on the erosion rate of composite has been analyzed .The erodent used here is dry silica sand having the size range 200-600μm. However, it is found that the composite shows brittle type failure and maximum erosion rate is observed at 90° impingement angle. Erosion wear rate is decreased with increasing the coir dust amount. The abrasive wear property of the composite is examined on a pin-on-disc machine against 400μm grit size abrasive paper with test speed of 0.540 m/sec and at normal loads 5,10,15,20, and 25N. The effect of coir dust concentration and sliding distance on the weight loss of composites has been analyzed. Abrasive wear resistance decreases with increase in normal load and increases with increasing fiber content. Further, the erodent and abrasive worn surface morphology is examined by using scanning electron microscope (SEM), and possible wear mechanisms are discussed. The hardness and flexural strength of the composite are also evaluated.

In order to improve the strength and to reduce the sensitivity to environmental influences, the interfacial adhesion between the natural fiber and the matrix material was improved by chemical treatment of the coir dust. Dielectric constant of treated coir dust composite was lower than of that of untreated coir dust composite, i.e. the dielectric strength of the composite increases and the increased dielectric strength makes these composites quite suitable for use as insulators.

Key Words: composite materials, orientation polarization, dielectric loss, conductivity, resistivity, dielectric relaxation, epoxy resin, erosion wear, abrasive wear, impingement angle, SEM.

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