Abrasive wear behaviour of epoxy composite based on kenaf fibres

B.F. Yousif, T.F. Yusaf

Faculty of Engineering & Surveying, University of Southern Queensland, Toowoomba, QLD 4350, Australia
Belal.Yousif@usq.edu.au

1. Introduction

Recently, there are wide researches on the possibility of using natural fibres as reinforcement for polymeric composites. One of the most promising natural fibres is kenaf fibre, which has high interfacial adhesion with synthetic matrix, and great specific tensile modulus [1]. Few attempts have been made to study the effect of oil palm, coir, or betelnut fibres [2, 3], on tribological characteristics of polyester composites. In those works, the composites exhibited very poor wear performance. due to the poor interfacial adhesion of the fibres with the matrix leading to pulling out of the fibres during the sliding. In the current work, the effect of high interfacial adhesion kenaf fibre on the abrasive wear performance of epoxy composite was studied under abrasive loading conditions. The worn surfaces were examined using SEM.

The kenaf fibres were chemically treated with 6% NaOH solution. The resin used in the current work is liquid epoxy (DER 331) and the curing agent is JOINTMINE 905-3S. The kenaf fibre reinforced epoxy (KFRE) composite was developed using closed mould technique. The volume fraction of the fibre in the matrix was about 48%. Surface of the developed KFRE composite is shown in Fig. 1. Three different orientations of fibres, with respect to the sliding direction of the counterface, were considered, Fig. 1. Block-On-Disk (BOD) machine was used for the current experiments, and the tests were performed by abrading the sample with an apparent area of contact of 11.5x11.5 mm^2 against three different grades (400, 1000, 1500, 2000) of Silicon Carbide (SiC) abrasive paper under 5-25 N applied loads and rotational speed of 50 rpm corresponding to 0.157 for test duration of 180sec.

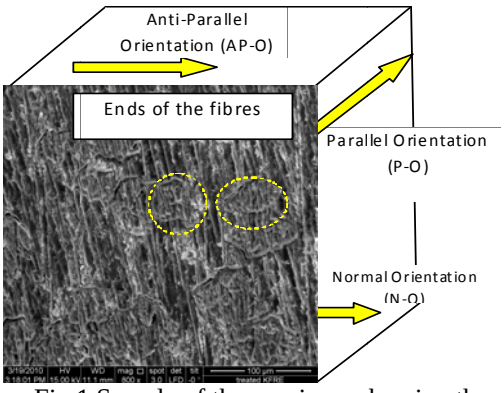

Fig.1 Sample of the specimen showing the orientations

2. Main Findings

Sample of the results is presented in Fig. 2 showing the wear rate of the KFRP composite at different orientations associated with neat epoxy (NE). The figure indicates that kenaf fibre orientation has very significant effect on the abrasive wear behavior of the epoxy composite. The lowest wear rate can be obtained when the fibres are oriented in N-O at all the SiC grades. Moreover, about 45% enhancement in wear performance of epoxy can be achieved by using kenaf fibres, in N-O, as reinforcement. Besides, increases the SiC grade reduces the *Wr* of all the materials. This is due to the large size of the SiC at lower grade.

The micrographs of the composite, tested against 400G, show high interfacial adhesion of the kenaf fibres with the epoxy matrix, i.e. there is no sign of debonding. However, it seems that the fibre oriented in N-O slightly damaged compared to the other orientations especially P-O. When the fibres are oriented in N-O, the end of the fibres carries the load and protects the resinous regions. On the other hand, the exposure of the whole fibre to the rubbing area causes high removal of materials especially in P-O due to the fact that the SiC particles ploughing the resinous and fibrous regions individually. In the case of N-O, both regions are rubbed normal to the side force which allows the particles to transfer for region to another and gives opportunely to the damaged particles to transfer from region to another. This could be the reason of the lower *Wr* of the composite in N-O compared to P-O.

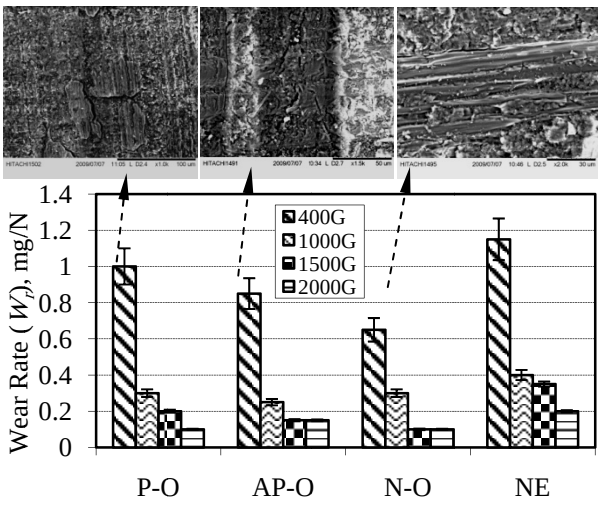

Fig.1 Wear rate, associated with SEM, of the KFRP at different orientations

3. References

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