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A Fully Biobased Tribology Material Based on Acrylic Resin and Short Wood Fibres

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ABSTRACT

A fully bio-based tribology material for bearing applications has been developed using a water soluble acrylic resin and short wood fibres. Formulated bio-composites were subjected to tribology examination against a polished 100 Cr6 steel ring using a block-on-ring test configuration. Specific wear rate and friction coefficient were determined. Specific wear rates ranged between 2.5×10^{-6} and 4.6×10^{-6} $mm^3/(Nm)$, and the coefficient of friction between 0.3 and 0.5 depending on fibre length. Oil impregnation of the samples led to a 50 % decrease in the coefficient of friction. Impregnated systems can produce specific wear rates in the range of 10^{-7} $mm^3/(Nm)$, and a coefficient of friction between 0.1 – 0.2. The impregnated systems can replace some currently used synthetic materials.

Keywords: Bio-based, Tribology, Short wood fibres, Oil impregnation, Sliding wear.

INTRODUCTION

In manufacturing structural members for automotive, aerospace and industrial machineries, attention is currently paid to light weight, ease of processing, cost effectiveness and environmental sustainability [2]. In addition, if the materials are subjected to relative sliding motion, they must accommodate properties such as increased lifetime, high wear resistance and low coefficient of friction. To satisfy these conditions, research efforts have been targeted on the use of polymer reinforced composites [2,3]. Fibre-reinforced polymer (FRP) composites have been used as tribology materials such as gears, seals, bushes and cams, in automotive and aerospace applications [4–8]. These materials are currently made from synthetic sources and have potential negative environmental imp act [9]. Moreover, in specific applications such as bearing, external lubrication raises issues of lubricant thinning which is a non-degradable waste [2]. To minimise or eliminate these issues, there is need for ‘bio-tribo-materials’ with limited or no external lubrication or even with self-lubricating abilities. This will particularly be interesting in pre-lubricated systems.

Several researchers have attempted the formulation of tribology materials based on natural fibre reinforced polymer composite [10–17]. These studies reported specific wear