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Exploration of Copper Fabric in Non-Asbestos Organic Brake-Pads for Thermal Conductivity Enhancement

Authors : Vishal Mahale, Jayashree Bijwe, Sujeet K. Sinha

Abstract : Range of thermal conductivity (TC) of Friction Materials (FMs) is a critical issue since lower TC leads to accumulation of frictional heat on the working surface, which results in excessive fade while higher TC leads to excessive heat flow towards back-plate resulting in boiling of brake-fluid leading to 'spongy brakes'. This phenomenon prohibits braking action, which is most undesirable. Therefore, TC of the FMs across the brake pads should not be high while along the brake pad, it should be high. To enhance TC, metals in the forms of powder and fibers are used in the FMs. Apart from TC improvement, metals provide strength and structural integrity to the composites. Due to higher TC Copper (Cu) powder/fiber is a most preferred metallic ingredient in FM industry. However, Cu powders/fibers are responsible for metallic wear debris generation, which has harmful effects on aquatic organisms. Hence to get rid of a problem of metallic wear debris generation and to keep the positive effect of TC improvement, incorporation of Cu fabric in NAO brake-pads can be an innovative solution. Keeping this in view, two realistic multi-ingredient FM composites with identical formulations were developed in the form of brake-pads. Out of which one composite series consisted of a single layer of Cu fabric in the body of brake-pad and designated as C1 while double layer of Cu fabric was incorporated in another brake-pad series with designation of C2. Distance of Cu fabric layer from the back-plate was kept constant for C1 and C2. One more composite (C0) was developed without Cu fabric for the sake of comparison. Developed composites were characterized for physical properties. Tribological performance was evaluated on full scale inertia dynamometer by following JASO C 406 testing standard. It was concluded that Cu fabric successfully improved fade resistance by increasing conductivity of the composite and also showed slight improvement in wear resistance. Worn surfaces of pads and disc were analyzed by SEM and EDAX to study wear mechanism.

Keywords : brake inertia dynamometer, copper fabric, non-asbestos organic (NAO) friction materials, thermal conductivity enhancement
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