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Wear Map for Cu-Based Friction Materials with Different Contents of Fe Reinforcement

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Abstract : Copper-based sintered friction materials are widely used in the brake system of different applications such as engineering machinery or high-speed train, due to the excellent mechanical, thermal and tribological performance. Considering the diversity of the working conditions of brake system, it is necessary to identify well and understand the tribological performance and wear mechanisms of friction materials for different conditions. Fe has been a preferred reinforcement for copper-based friction materials, due to its ability to improve the wear resistance and mechanical properties of material. Wear map is well accepted as a useful research method for evaluation of wear performances and wear mechanisms over a wider range of working conditions. Therefore, it is significantly important to construct a wear map which can give out the effects of work condition and Fe reinforcement on tribological performance of Cu-based friction materials. In this study, the copper-based sintered friction materials with the different addition of Fe reinforcement (0-20 vol. %) were studied. The tribological tests were performed against stainless steel in a ring-on-ring braking tester with varying braking energy density (0-5000 J/cm2). The linear wear and friction coefficient were measured. The worn surface, cross section and debris were analyzed to determine the dominant wear mechanisms for different testing conditions. On the basis of experimental results, the wear map and wear mechanism map were established, in terms of braking energy density and the addition of Fe. It was found that with low contents of Fe and low braking energy density, adhesive wear was the dominant wear mechanism of friction materials. Oxidative wear and abrasive wear mainly occurred under moderate braking energy density. In the condition of high braking energy density, with both high and low addition of Fe, delamination appeared as the main wear mechanism.

Keywords : Cu-based friction materials, Fe reinforcement, wear map, wear mechanism
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