Investigations on Wear of Brake Pads

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Preface

The current work originates from my researches at Institute of Dynamics and Vibrations in Braunschweig University of Technology.

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Abstract

With the rapid development of automobile industry, the brake pad as a significant consumed component is widely used in the disc brake system. Wear behaviors of brake pads play a significant role in the brake performance, directly related to the security of vehicle and the human healthiness. The wear of brake pads is always a highlight and difficulty in the tribological field. Based on previous investigations, the wear of brake pads is influenced by many elements, such as the normal load, the relative velocity, the duration of friction, the temperature, the surface roughness, material properties and some surrounding factors. A lot of wear models are proposed from different theories and tests. However, these proposed wear models are hard used to give reasonable interpretations for wear phenomena of brake pads under different friction conditions.

This paper gives a new insight into the wear of brake pads during different friction processes, on the aspect of the dissipated energy. A new wear description is first introduced to be a piecewise function with respect to the normal load, based on the adhesion theory of friction and its extensions. This new wear description physically demonstrates various correlations between the wear of brake pads and the dissipated energy during different friction processes. It is also used to preliminarily evaluate wear resistances of brake pads under different friction conditions, even without friction tests. Moreover, the new wear description can provide theoretical guidance for manufactures and quality inspections of brake pads.

Wear of brake pads are measured under four different friction scenarios, namely when the nominal work of friction is same and different in each friction process, when the loading order is different over the whole test procedure and when the relative sliding direction is different. The whole test procedure is implemented using the IDS high load tribometer for friction tests and the new device of non-contact wear measurement for wear measurements. Results of tests well illustrate different linear correlations between the wear of brake pads and the dissipated energy, under various levels of normal loads without reaching high temperatures. The wear resistance of brake pads is directly dependent of the normal load, the loading order, the relative sliding direction and material properties, rather than the velocity and the duration of friction. These test results can be adequately interpreted by the new wear description. Additionally, the linearity between the wear of brake pads and the dissipated energy is influenced by dynamic friction effects.

Some effect elements for wear measurement results of brake pads are preliminarily discussed in the end, such as errors from the non-contact wear measurement and the effect of material relax of brake pads.

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