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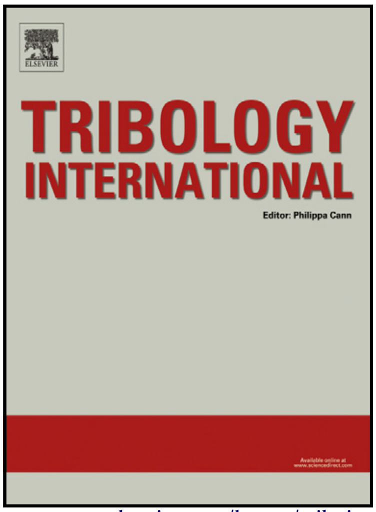

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Effect of normal load on friction coefficient for sliding contact between rough rubber surface and rigid smooth plane

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Abstract

This study focused on the normal load dependence of the friction coefficient for the sliding friction of a rubber material with a rough surface. A developed friction tester was used to visualize the real contact regions distributed within the transparent contact interface between poly-dimethyl siloxane (PDMS) and glass surfaces. Based on experimental results, an adhesion friction model was developed to explain the normal load dependence of the friction coefficient. This model provides a simple technique that can roughly but easily estimate the real contact area and shear stress without in situ observation of the contact interface.

Keywords: Friction coefficient, Normal load, Rubber, Real contact area

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The friction model is an important subject in the design stage of mechanical systems involving contacting surfaces. An accurate friction model contributes to the development of numerical simulations; it can promote the primary performance of intended systems and avoid problems such as the occurrence of friction-induced vibrations. However, modeling the friction is not easy because the friction force depends on a number of system parameters such as the sliding speed, normal load, surface roughness, and contact configuration [1, 2].

Understanding the contact mechanism is imperative to establish an accurate model of sliding systems. For conventional metallic materials, a number of theories considering the elastic, plastic, and elasto-plastic deformations of contacting asperities have been established to explain the contact mechanism by theoretically predicting the total area of real contact regions [3-8]. Some of these theories describe the total area of real contact regions A_{real} as linearly increasing with the normal load W, i.e., $A_{real} \propto W$. Therefore, assuming that the friction force F can be derived as the product of the total area of contact A_{real} and the shear strength τ, the

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