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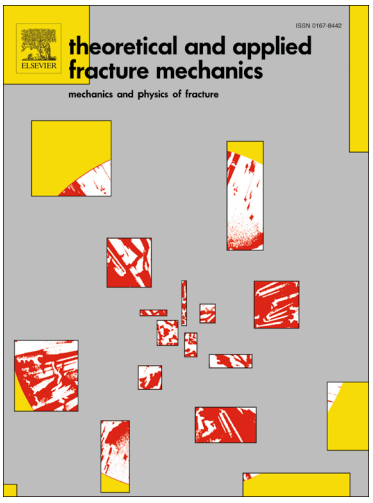

Prediction of friction coefficients in nanoscratch testing of metals based on material flow lines

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Prediction of friction coefficients in nanoscratch testing of metals based on material flow lines

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Abstract

In nanoscratch experiments, the frictional shear force vector applying on each element of the contact surface between the nanoindenter and material is in the direction of material flow lines or relative displacement vectors. In this paper, the material flow lines in the nanoscratch test around the Berkovich nanoindenter in the face-forward orientation are investigated. The finite element simulation of nanoscratch test is conducted to calculate and track the trajectory of the material points located on the material surface. The material flow lines around the nanoindenter are qualitatively and quantitatively explained and a new method entitled *focal point method* is proposed to describe the material flow lines in the contact surface. The evolution of the material flow lines in terms of the material properties and local friction coefficient is studied. The adhesive friction coefficient is calculated using the pattern of flow lines obtained by the focal point method. There is a close agreement between the predicted friction coefficients and those obtained from the finite element simulation and experiment, so that the error percent is about 5.7%.

Key words: Nanoscratch; Material flow line; Berkovich nanoindenter; Friction coefficients

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