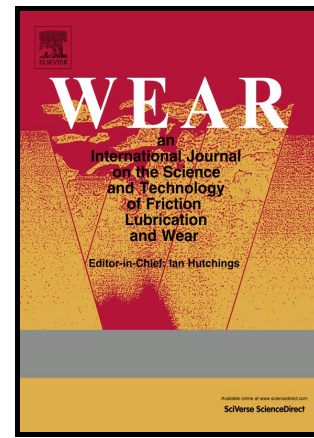


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Equivalent cone apex angle of Berkovich indenter in face-forward and edge-forward nanoscratch

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Abstract

To simulate a nanoindentation test, the conical indenters with an equivalent cone apex semi-angle are often used instead of actual 3D Berkovich indenter in order to reduce the analysis time duration and also to obtain the analytical relations to describe the phenomenon. The aim of this paper is to investigate whether it is possible to use a conical indenter with an equivalent cone apex semi-angle instead of Berkovich indenter for both edge-forward and face-forward orientations in the nanoscratch test. Generating a correlation between the Berkovich and conical indenters during the nanoscratch test to find an equivalent cone apex semi-angle is the main objective of the present study. For this purpose, finite element method is employed to simulate the nanoscratch test for a metallic material. The equivalent cone apex semi-angles for edge and face-forward orientations of Berkovich indenter are calculated by two approaches; (i) mean contact height equality and (ii) apparent friction coefficient equality. The results reveal that different equivalent cone apex semi-angles are obtained as per each of the two approaches. The effect of local friction coefficient on the equivalent cone apex semi-angle is also investigated.

Keywords: Nanoscratch; Berkovich; Face-forward; Edge-forward; Equivalent cone apex semi-angle

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