A New Analytical Model for Estimation of Scratch-Induced Damage in Brittle Solids

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Abstract:

Scratch tests are of fundamental interest both for understanding machining-induced damage and for evaluating the scratch resistance of brittle materials. An improved blister field model for the scratch process is proposed where the blister field strength is explicitly determined in terms of the material properties, loading conditions, and geometry of the scratch tool. Additionally, one new expanding cylindrical cavity model is implemented to estimate the plastic zone size surrounding the scratch groove. A quantitative evaluation of the damage zone size is conducted by combining the above two models. The predicted damage zone sizes are in good agreement with the results available elsewhere in literature.