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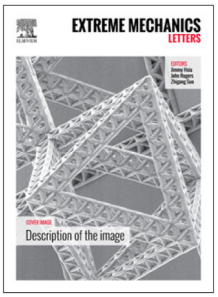


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# Extended Hencky solution for the blister test of nanomembrane

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## Abstract

The blister test has been extensively used as a simple and effective approach to measure the elastic modulus and the interface adhesion energy of two-dimensional nanomembrane. However, the conventional blister test model is commonly based on the Hencky solution in which the clamped boundary is assumed without consideration of sliding, and consequently, it can hardly obtain the stress distribution outside the blister region. Therefore, in this paper, the clamped boundary condition is removed, and the Hencky solution is extended based on the Lame solution to account for both the sliding displacement and the stress and strain fields outside the blister region. The expression of the extended Hencky solution is as simple as the original one, but it provides a more accurate description for both the blister configuration and the stress and strain fields of nanomembrane, which are proved by molecular dynamics (MD) simulations of graphene blister test. Our theoretical model is further validated by the experimental results regarding the blister test of a monolayer graphene membrane, where a higher accuracy can be observed in the interpretation of the data.

**Keywords:** Hencky solution, blister test, adhesion energy, graphene, two-dimensional nanomaterials

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