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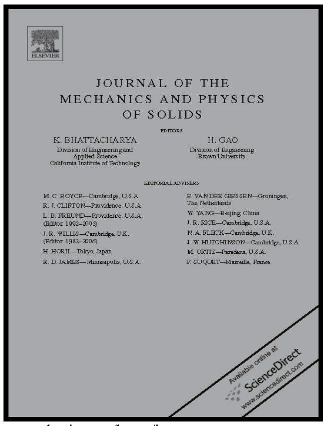

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A Theoretical Consideration of the Ballistic Response of Continuous Graphene Membranes

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Abstract

The remarkable properties of graphene, including unusually high mechanical strength and stiffness, have been well-documented. In this paper, we combine an analytical solution for ballistic impact into a thin isotropic membrane, with *ab initio* density functional theory calculations for graphene under uniaxial tension, to predict the penetration resistance of multi-layer graphene membranes. The calculations show that continuous graphene membranes could enable ballistic barriers of extraordinary performance, enabling resistance to penetration at masses up to 100× lighter than existing state-of-the-art barrier materials. The very high elastic wave speed and strain energy to failure are the major drivers of this increase in performance. However, the in-plane mechanical isotropy of graphene, as compared to conventional orthotropic