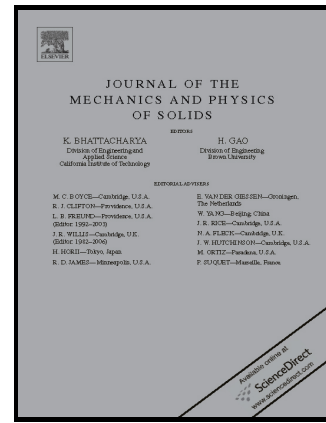


Author's Accepted Manuscript

A theoretical consideration of the ballistic response of continuous graphene Membranes

Eric D. Wetzel, Radhakrishnan Balu, Todd D. Beaudet



PII: S0022-5096(15)00113-1
DOI: <http://dx.doi.org/10.1016/j.jmps.2015.05.008>
Reference: MPS2648

To appear in: *Journal of the Mechanics and Physics of Solids*

Received date: 22 January 2015
Revised date: 1 May 2015
Accepted date: 15 May 2015

Cite this article as: Eric D. Wetzel, Radhakrishnan Balu and Todd D. Beaudet, A theoretical consideration of the ballistic response of continuous graphene Membranes, *Journal of the Mechanics and Physics of Solids*, <http://dx.doi.org/10.1016/j.jmps.2015.05.008>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

A Theoretical Consideration of the Ballistic Response of Continuous Graphene Membranes

Eric D. Wetzel*, Radhakrishnan Balu, and Todd D. Beaudet

U.S. Army Research Laboratory

Weapons and Materials Research Directorate and Computational and Information Sciences

Directorate

Aberdeen Proving Ground, MD 21005

*eric.d.wetzel2.civ@mail.mil, 410-306-0851

Submitted to:

Journal of the Mechanics and Physics of Solids

Submission date: 22 January 2015

Revision date: 30 April 2015

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

Download English Version:

<https://daneshyari.com/en/article/7177968>

Download Persian Version:

<https://daneshyari.com/article/7177968>

[Daneshyari.com](https://daneshyari.com)