Super stretchable hexagonal boron nitride Kirigami

Tongwei Han, Fabrizio Scarpa, Neil L. Allan

PII: S0040-6090(17)30254-7
DOI: doi: 10.1016/j.tsf.2017.03.059
Reference: TSF 35907

To appear in: *Thin Solid Films*

Received date: 19 December 2016
Revised date: 21 March 2017
Accepted date: 30 March 2017

Please cite this article as: Tongwei Han, Fabrizio Scarpa, Neil L. Allan , Super stretchable hexagonal boron nitride Kirigami. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Tsf(2017), doi: 10.1016/j.tsf.2017.03.059

Super stretchable hexagonal boron nitride Kirigami

Tongwei Han[1*], Fabrizio Scarpa[2]*, Neil L. Allan[3]

[1]School of Civil Engineering and Mechanics, Jiangsu University, Jiangsu Zhenjiang 212013, P. R. China

[2]Advanced Composites Centre for Innovation and Science, University of Bristol, Bristol BS8 1TR, UK

[3]School of Chemistry, Cantock's Close, University of Bristol, Bristol BS8 1TS, UK

Abstract Kirigami, the ancient Japanese art of cutting and folding paper at the macroscale, has been recently applied to produce nanostructures with unusual deformation mechanisms. In this work we analyse the mechanical properties and deformation mechanisms leading to remarkable stretching and bilinear stiffness in armchair and zigzag hexagonal boron nitride (h-BN) Kirigami nanosheets using classical molecular dynamics simulations. We identify three geometric parameters that govern the mechanics and ductility of Kirigami h-BN. Enhancements in tensile strains up to 3-5 times higher than those of pristine h-BN can be obtained. The variations of stiffness, ultimate strength and strain with the parameters defining the Kirigami defect patterns can be used to tune the mechanical properties of h-BN and other nano 2D structures, potentially expanding their applications in bio-compatible strain-engineered nanodevices and nanoelectronics.

Keywords: hexagonal boron nitride; Kirigami; mechanical properties; molecular dynamics.

Corresponding author. E-mail address: f.scarpa@bristol.ac.uk, twhan@ujs.edu.cn