



Abstract of Keynote Speech 1

Case-studies on Interface Mechanics: From Interface-governed Strength in Graphene to Crack-deflection in Shales

Y.J. Wei

DLNM, Institute of Mechanics, Chinese Academy of Sciences, Beijing 100190, China
School of Engineering Sciences, University of Chinese Academy of Sciences, Beijing 100049, China

yujie_wei@lnm.imech.ac.cn

Abstract

Interfaces are ubiquitous. They have a strong impact on the mechanical reliability of advanced materials and engineering structures. The scale of interfaces ranges from angstroms to macroscopic scales in meters or even greater.

In this talk, we present mechanics of how nanoscale interface in graphene may influence the strength of the materials [1-7], including (1) the interface during making large-area single-layer graphene with patches of single-crystalline graphene, and how typical defects like pentagon-heptagon rings in grain boundaries would influence the strength of polycrystalline graphene; (2) during dimension scale-up to make three-dimensional graphene honeycomb using two-dimensional graphene, and what is the stable structure of those 3D carbon honeycomb and how is its mechanical properties.

At the macroscopic scale, we will explain how weak interfaces in shales may influence the hydraulic fracture behavior. We showed theoretically the strain energy release rate of a hydraulic crack with arbitrary angles with respect to the crustal stress, and deduced the closed-form solution to the hydraulic deflection criterion when factors including crustal stresses and crack-face friction are taken into account [8, 9].

References

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