

1. Abstract

Project Code : MRG6080189

Project title: (Thai) แบบจำลองทางกลศาสตร์ที่คำนึงถึงอิทธิพลของหน่วยแรงที่ผิวสำหรับการวิเคราะห์ฟิล์มนาโนบนวัสดุยืดหยุ่นและวัสดุเชิงประกอบเสริมด้วยอนุภาคนาโน

(English) Mechanistic Model Incorporating Surface Stress Effects for Analysis of Nanofilms on Surrounding Elastic Medium and Nano-sized Particles Reinforced Composite Materials

Investigator : Yasothorn Sapsathiarn, Mahidol University

E-mail Address : yasothorn.sap@mahidol.ac.th

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Nano-scale materials and nanostructures, such as nanoparticles, nanotubes, nanofilms and nanocomposites, are the key components of nano-scale devices. Mechanics of nanomaterials and structures can be understood by incorporating the effect of surface and interfacial energy. Mechanistic models incorporating surface stress effects are developed in this study and applied to examine the influence of surface free energy on the elastic behavior of nanofilms on surrounding elastic medium and nano-sized particles reinforced composite materials. A set of analytical techniques for stress and displacement fields corresponding to elastic nanolayer based on Love's representation, Hankel and Fourier integral transforms are adopted to derive explicit integral form solutions for nanolayer problems. A new three-dimensional finite element formulation for analysis of nanoparticle-reinforced composites is developed in the present work. The finite element model of nanoparticle-reinforced composites provides an efficient tool to analyze and predict the mechanical response of nanocomposites with practically useful arbitrary shaped nano-scale particles, multiple particles, non-symmetric loading, etc. Selected numerical results are presented to portray the features of the field responses of nanofilm-substrate system and properties of nanocomposite materials.

Keywords: Nanotechnology; Mechanistic model; Nanocomposites; Nanofilms; Surface free energy