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ABSTRACT

The dynamic response of a rectangular nanoplate subjected to the low velocity impact by a nanoparticle is theoretically investigated. The van der Waals interaction between the particle and the plate is taken into account. Using the theory of surface elasticity and Hamilton's principle, the governing equations of the nanoplate are derived. Both the effects of surface elasticity and residual surface stress of the nanoplate are incorporated. Numerical examples are given for a silicon nanoplate impinged by a carbon nanoparticle. The physical mechanism of the impact behavior at the nanoscale is explained, and it is found that the interaction between the nanoparticle and the nanoplate exhibits different characteristics in comparison with the classical macroscopic impact. The surface effect of the nanoplate, the impact velocity and mass of the nanoparticle play a significant role in the impact force and dynamic response of the nanoplate.

Keywords: Nanoplate, Surface effect, Impact, Van der Waals interaction

1. Introduction

Collisions of objects occur in a variety of engineering fields. The collisions between two deformable bodies involving elastic and plastic deformations and failure

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