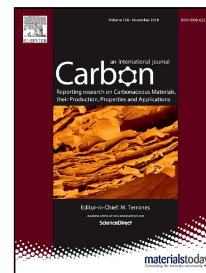


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**Buckling behaviors of metal nanowires encapsulating carbon
nanotubes by considering surface/interface effects from a refined
beam model**

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Abstract

We develop a refined beam model to describe the buckling characteristics of **hollow metal** nanowires encapsulating carbon nanotubes (**NWs@CNTs**), where the interfacial van der Waals (vdW) interaction, interfacial shear stress as well as surface effect are taken into consideration. The analytical expressions for cohesive **energies** of the vdW interaction between **carbon nanotubes (CNTs)** and hollow nanowires are obtained through continuum modeling. The interfacial shear coefficients for **NWs@CNTs** with **CNTs** of different diameters and nanowires of different lattice orientations are derived by molecular dynamics simulations. The surface effects of nanowires are addressed by a function of the bulk surface energy density and surface relaxation parameter. The present results show that **all** the aforementioned three factors play key roles in the buckling behaviors of **NWs@CNTs**. In particular, the competition between **CNTs** and

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