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Effect of vacancies on the mechanical properties of CNT based Composites

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The multiscale modeling approach for simulating the carbon nanotube based composites is analyzed. The atomic vacancies are found in carbon nanotubes, which affect the elastic properties of carbon nanotubes reinforced composites. The strength analysis has been carried out for carbon nanotube reinforced composites under the effect of tensile load. The multiscale representative volume element approach is proposed for modeling the elastic behavior of carbon nanotubes reinforced composites. The point masses applied on each node are coinciding with the carbon atoms work as mass of beam elements. The structure of carbon nanotube is created using beams and point masses based three dimensional space frame structure. The matrix phase incorporates the continuum modeling approach, while carbon nanotube characterizes the atomistic finite element model based on a molecular structural mechanics approach. The interfacial zone is modeled using beam elements. It is observed that the presence of a single vacancy defect adversely affects the effective strength and elasticity modulus of nanocomposites for a constant value of relative elasticity ratio Et/Em. It has also been observed that, change in locations of vacancy defect, leads to change in elastic strength of nanocomposites. The finite element results are compared with the Rule of mixtures using formulae. It is found that the results offered by proposed model, are in close proximity with those obtained by the rule of mixtures.

Biography

Anand Y Joshi completed his Ph.D. from Mechanical & Industrial Engineering Department, Indian Institute of Technology Roorkee, India. He is currently working as a Professor in Mechatronics Engineering at G.H.Patel College of Engg & Tech., Vallabh Vidyanagar, Gujarat, India. He has published more than 15 papers in reputed journals and serving as an editorial board member, invited reviewer and member of the scientific committee in a number of journals of high repute. He is also an expert registry in the nanomission project of Govt. of India.

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