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[Keynote Talk]: Three Dimensional Finite Element Analysis of Functionally Graded Radiation Shielding Nanoengineered Sandwich Composites

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Abstract : In recent years, nanotechnology has played an important role in the design of an efficient radiation shielding polymeric composites. It is well known that, high loading of nanomaterials with radiation absorption properties can enhance the radiation attenuation efficiency of shielding structures. However, due to difficulties in dispersion of nanomaterials into polymer matrices, there has been a limitation in higher loading percentages of nanoparticles in the polymer matrix. Therefore, the objective of the present work is to provide a methodology to fabricate and then to characterize the functionally graded radiation shielding structures, which can provide an efficient radiation absorption property along with good structural integrity. Sandwich structures composed of Ultra High Molecular Weight Polyethylene (UHMWPE) fabric as face sheets and functionally graded epoxy nanocomposite as core material were fabricated. A method to fabricate a functionally graded core panel with controllable gradient dispersion of nanoparticles is discussed. In order to optimize the design of functionally graded sandwich composites and to analyze the stress distribution throughout the sandwich composite thickness, a finite element method was used. The sandwich panels were discretized using 3-Dimensional 8 nodded brick elements. Classical laminate analysis in conjunction with simplified micromechanics equations were used to obtain the properties of the face sheets. The presented finite element model would provide insight into deformation and damage mechanics of the functionally graded sandwich composites from the structural point of view.

Keywords : nanotechnology, functionally graded material, radiation shielding, sandwich composites, finite element method
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