

Composites under Harsh Environments: Civil Engineering perspectives

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Abstract: The work presents an overview of the current state of the art in low temperature effects on materials in terms of durability and safety of vehicles. Susceptibility of composites to failure at low temperature is a critical issue for the aerospace industry. Spacecrafts operate at temperatures well below -200°C . High altitudes aircrafts routinely fly at -70°C to -100°C . These low temperatures result in two competing effects on composite stiffness. One beneficial effect involves increased stiffness because the polymer matrix would harden at low temperature. The other detrimental effect involves increased thermally-induced stress, which produces microcracks in matrix, which in turn, reduces the overall stiffness of the composites. These two competing beneficial-detrimental phenomena at the microstructure level have been studied for decades, but a quantitative understanding of the interplay of these two effects has continued to elude the researchers. Additional complexities arise when the stiffness increase effect is considered because of high strain rate loading. Long term exposure to cyclic or vibration can again reduce the stiffness. The competing effects for fatigue of fiber-reinforced polymer composites at low temperatures will be presented. Emphasis will be on civil engineering structural and other involving earthquake applications, orthogrids, FRP rebars, sandwich structures, guardrails, piers and structural members.

Presenter: Dr. David Hui is Professor of Mechanical Engineering and Director of Composites Materials Research Laboratory at University of New Orleans. He has served as founder and editor-in-chief of one of the most prestigious journals in composite materials, Composites B Engineering journal. Dr. Hui has co-authored approximately 200 technical publications, and received over 209,000 citations on his widely cited, edited books (from google) and over 2,000 citations on his journals publications (from ISI). Dr. Hui has made over 12,000 editorial decisions on scientific papers, as editor of many journals and proceedings books, mostly on composites or nano materials and structures.

