Comprehensive Study on the Mechanical Properties of Multi-Scale Hybrid Composites/ CNT–Coated Fibers

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Multi-Scale Hybrid Composites

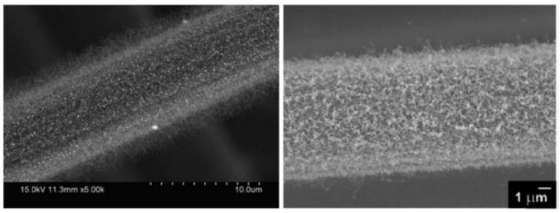
- Fiber reinforced composites + Nano-materials
- Nano-materials: Carbon Nanotubes, Nano-clay, Graphene

The Main Advantages:

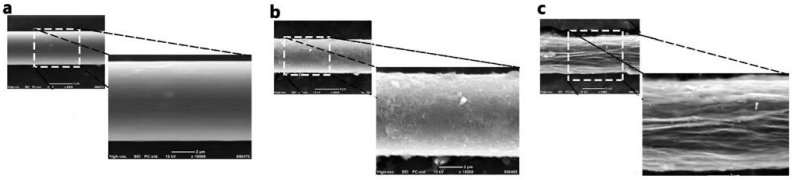
- Extraordinary improvement of interfacial strength between fiber and matrix
- Remarkable improvement of interlaminar strength in the laminated composites
- Utilizing CNT- coated fabrics as health monitoring sensors
- Increasing the thermal and electrical conductivity
- Improvement of corrosion resistance of fabrics
- Remarkable improvement of impact resistance of laminated composites

Producing the CNT-coated Hybrid Composites

I. Growing CNT on the surface of core fiber employing CVD or electrophoresis
II. Using the usual procedure of composites production such as RTM method



single fuzzy fiber with predominantly radially oriented CNT's (left) and randomly oriented CNT's (right) on the surface of the carbon fiber



SEM images of the (a) desized CF, (b) CNTs/CF, and (c) GO/CF

Three-Dimensional Stress Analysis of Nano-Stitched Advanced Laminated Composites

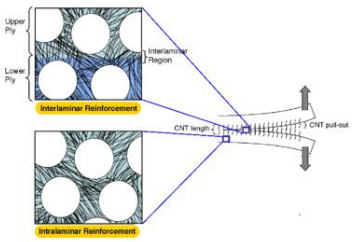
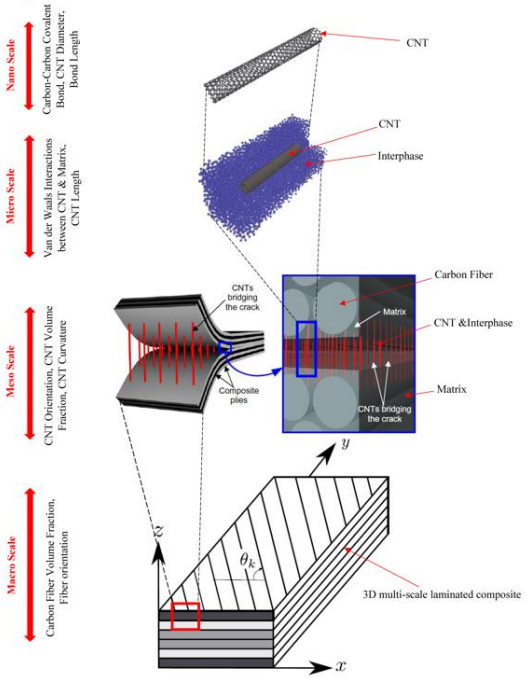
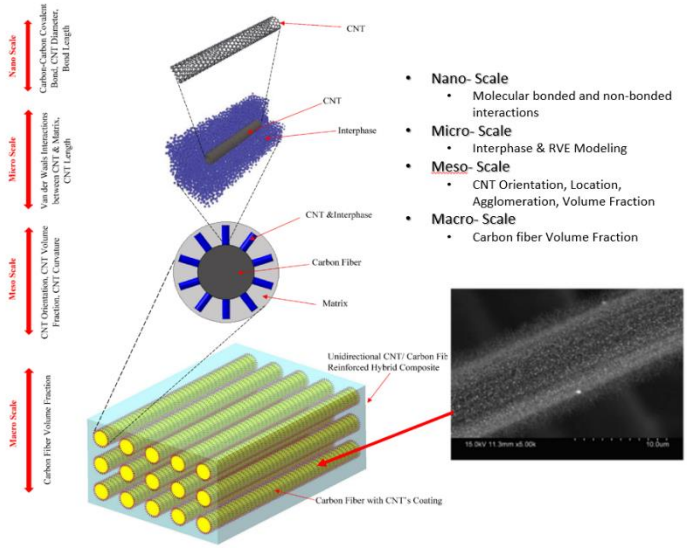


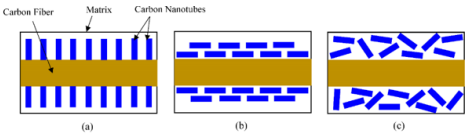
Illustration of Interlaminar and Intralaminar reinforcement from CNT's



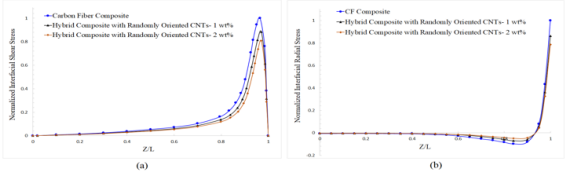
Modeling & Analysis Procedure of Hybrid Composites- Interfacial Strength



- Nano- Scale
  - Molecular bonded and non-bonded interactions
- Micro- Scale
  - Interphase & RVE Modeling
- Meso- Scale
  - CNT Orientation, Location, Agglomeration, Volume Fraction
- Macro- Scale
  - Carbon fiber Volume Fraction

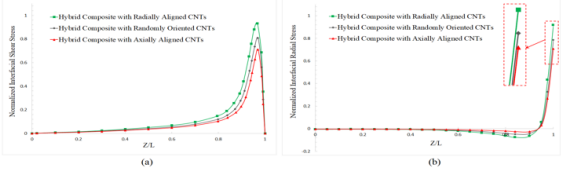


(a) radially aligned CNT's (b) axially aligned CNT's (c) randomly distributed CNT's



The normalized interfacial stress distribution, (a) Interfacial shear stress, (b) Interfacial radial stress

Decreasing the maximum interfacial stress by about 20%, considering mere 1.5 wt.% CNT



The normalized interfacial stress distribution for different CNT's configurations, (a) Interfacial shear stress, (b) Interfacial radial stress