The utilization of cement or highly branched polymer (e.g., epoxy resins) are often limited by their brittle nature (low fracture toughness). Loading these matrices by fillers such as individual nanotubes is a promising alternative to enhance fracture toughness without compromising other mechanical properties. In my presentation I will show microscopy characterization of composite systems. A record fracture toughness enhancement in polymer and cement matrices has been achieved using a novel dispersion method. The individual nanotube concentration in the composite is accurately determined. We also demonstrate a coherent quantitative correlation between the fracture toughness and the surface roughness. Finally, comprehensive statistical investigation of the nanotube failure mechanisms shows that carbon nanotubes fail via fracture mechanism, while tungsten di-sulfide nanotubes via pullout mechanism.

The basics of cryogenic transmission electron microscopy (cryo-TEM) technique, available in Texas A&M and employed in this work (to study liquids at nm resolution) will be presented.

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