Nanomechanical characterization of polymer nanocomposites

OVERVIEW: The rapidly expanding field of nanocomposites is generating many new materials with novel properties that are not generally predictable. However, designing these nanocomposites for industrial applications requires a refined understanding of their structure–property–function relationships. The macroscopic mechanical behavior of nanocomposites depends not only on the properties and volumetric proportions of the constituent components, but also on their morphology and interfacial characteristics. The aim of my research is to elucidate how the addition of nanoparticles affects the mechanical response (E', E'', and scratch resistance) of polymers, particularly at the matrix-particle interphase.

OBJECTIVES:
• Identify experimental means to measure relevant local mechanical properties of the different material phases in nanocomposites and spatially map these properties.
• Relate key mechanical properties to morphology of nanocomposite polymers by using instrumented methods such as atomic force microscopy and nanoindentation.
• Investigate the impact of the polymer structure and chemistry at the polymer-particle interface on the macroscopic behavior of the nanocomposite.

APPROACH:
Mechanical characterization of small volumes of material can be done using depth-sensing indentation tests. While nanoindentation can measure macroscopic properties, Atomic Force Microscopy (AFM) allows both imaging of the individual phases and mechanical property measurements. For this project experiments using both instruments will be conducted.

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Interesting fact: I like fishing.

References:
• Fischer-Cripps A. Nanoindentation, 2004 New York.