

Understanding the behavior of heterogeneous materials across multiple length scales

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There are numerous materials that have one or more levels of spatial heterogeneity. Prediction of their mechanical response at the macroscale clearly depends on the understanding of the local behavior. Thus, necessary measurement approaches are needed to understand these materials.

The first half of the presentation will focus on the propagation of ultrasound through polycrystalline media. Due to the spatial heterogeneity of such materials, scattering of ultrasound occurs that is dependent on the wave frequency. The scattered wave fields can be used to quantify the material microstructure and changes that may occur due to various loading or manufacturing processes.

In the second half of the presentation, synthetic and bio-polymers will be discussed with respect to their thermomechanical behavior at the micro- and nano-scales. Nanoindentation and atomic force microscope methods can help quantify this behavior, but knowledge of each measurement system requires carefully calibrated models.