

Materials by Design through Heterogeneous Structures

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Nature has given us some remarkable examples of creating critical functionalities through the heterogeneous structural control of basic component molecules. Some examples include bones, superhydrophobic surfaces, and iridescence colors. It has been well known that the properties of polymers can be improved through blends and fillers. However, the length scale of these heterogeneous structures is too big to have sufficient interaction with light, electron, and molecular chains. Only with the arrival of effective characterization tools such as scanning tunneling microscope, atomic force microscope and other enhanced traditional analytical tools, it becomes possible to create, characterize and understand the interplay of nanosized heterogeneous structures. In this talk, we will discuss some new heterogeneous structures and their unique properties enabled by the control of the heterogeneous structure at nanoscale. Specifically we will discuss material properties that are important for industrial applications such as mechanical, thermal mechanical, optical properties, and thermal conductivity.