Imaging of short range order with electron microscopy: from high performance alloys to semiconductor thin films

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This talk will describe our recent results utilizing energy filtered diffraction, 4D-STEM and in situ TEM nanomechanical testing that provide insight into the determination and role of short range order (SRO) in materials. Examples will be presented from structural alloys such as α-titanium and the CrCoNi medium entropy alloy, as well as semiconductors such as a SiGeSn/GeSn multilayer. We will consider the role of both SRO and planar defects in the both the mechanical response as well as structural determination via electron diffraction as a function of heat treatment in the CrCoNi MEA. Lastly, we will discuss both the strengths and limitations of TEM methods for analyzing SRO in these systems, with particular emphasis on coordinated computational methods to simulate diffraction patterns in order to directly compare with experimental measurements.