Understanding Material Structure and performance with 3D X-ray Imaging

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Materials scientists have a wide variety of X-ray tools available to analyze the composition, morphology, and response of materials to external stress. Laboratory-based 3D systems including confocal micro-X-ray fluorescence (confocal MXRF), as well X-ray micro- and nano-scale X-ray tomography (CT) image materials both before and after experiment are useful in understanding a materials starting conditions and response to experiment. For true in situ imaging, especially for elastomeric materials which continue in their stress-relaxation response even after a uniaxial load is paused, synchrotron based X-ray tomography is critical in understanding mechanical response. Using CT as a starting point for the finite elemental modeling of both mechanical performance as well as electromagnetic field effects for the dissipation of energy is imperative in that CT provides a robust starting point, and when coupled with in situ measurements, can be used for code validation. This presentation will discuss in situ and quasi static in situ measurements of elastomeric foams with FEA mechanical modeling, and FEA modeling of electromagnetic response and heat transfer within plastic bonded explosives.