Defects in Energetic Materials Insensitive Munitions MURI

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Ultimate Objective is to Understand Sensitivity

Current Goals

Determine structures at high pressures of EM such as PETN, sensitive and insensitify RDX, HMX and structures near impurities

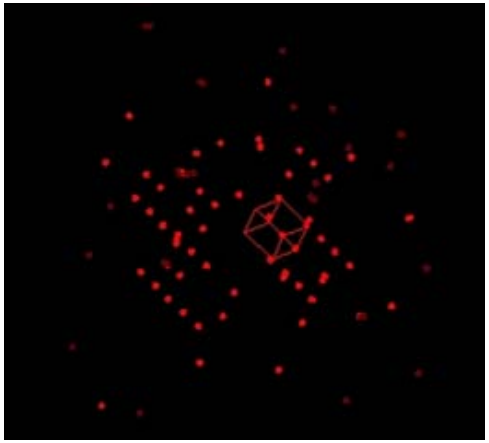
Scientific Challenges

•Design of EM with prescribed properties requires fundamental understanding of contributions of defects and transitions to sensitivity mechanisms

•Large, defected unit cells challenge current high pressure X-ray diffraction methods

•There are many ideas about involvement of HMX in RDX with no specifics for known phases

TATB diffraction pattern



Reciprocal space pattern (red spots on black background) of TATB at 1 GPa gives the orientation of the crystal

Major Accomplishments and Findings

•Molecular conformations in γ-RDX were shown to be disordered and previous structure determination is wrong

•XRD patterns obtained for sensitive RDX identify β-HMX crystals as impurities which are not present in insensitive RDX

•First single-crystal patterns of TATB collected. These are needed for accurate structural determination

Publications: *In preparation*

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Army Relevance

•These results will enable modeling of local structures in RDX around HMX defect to understand role of HMX defects on RDX sensitivity

•Use and design of EM will be much safer, more reliable, and predictable

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