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Metastable Polymeric Nitrogen: The Ultimate Green High-Energy-Density Material JENNIFER CIEZAK, US Army Research Laboratory — High-energy-high-density materials offering increased stability, vulnerability, and environmental safety are being aggressively pursued to meet the requirements of the DoD Joint Visions and Future Force. Nearly two decades ago, it was proposed that polymeric nitrogen would exceed all of these requirements and possess nearly five times the energy of any conventional energetic material in use today. The present study details an investigation into nitrogen polymerization using a novel high-pressure approach utilizing sodium azide as the starting material. Due to the weaker bonding structure of the anionic azide chains in comparison to a N-N triple bond, one expects that the azide chains will create single-covalently bonded polymeric networks more easily than diatomic nitrogen. A polymeric form of sodium azide was synthesized at high pressures, but the material was not metastable at ambient conditions, which precluded performance testing. Quantum chemical calculations have indicated stabilization of the polymeric structure at ambient conditions may be possible with the addition of hydrogen. Vibrational spectroscopic characterization suggests that a meta-stable polymeric form of nitrogen has been synthesized under high-pressure using sodium azide/hydrogen as the starting materials. This material remains stable at ambient conditions upwards of two weeks depending on the storage conditions.

Jennifer Ciezak
US Army Research Laboratory

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