

Abstract Submitted
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Thermal Decomposition Behavior of Poly(3-nitratooxetane)

BRIAN MASON, ALIZA CRUZ, CHAD STOLTZ, IHDIV Naval Surface Warfare Center — Poly(3-nitratooxetane), or PNO, is a new high-energy density polymer that is expected to increase formulation energy output without sacrificing binder stability. It is anticipated that using PNO in propellant formulations will be advantageous compared to other energetic binders such as its structural isomer poly(glycidyl nitrate) (PGN). In an effort to understand the combustion behavior of this new energetic polymer, thermal decomposition of PNO has been investigated. Differential scanning calorimetry coupled with thermal gravimetric analysis shows that this material is thermally stable to at least 150°C and that exothermic decomposition peaks near 203°C. T-Jump/FTIR was used under various conditions to identify gas-phase thermal decomposition products, including H₂O, CH₂O, CO₂, CO, N₂O, NO, NO₂, and HONO (cis and trans). Additional time-resolved T-Jump/FTIR experiments suggest immediate dissociation of NO₂ as the obvious first step in PNO decomposition, while previous work on the PGN polymer system suggests that the entire CH₂ONO₂ side chain breaks from the PGN backbone before dissociation. It is likely that different decomposition pathways are followed for each binder system due to location of available C-O and N-O moieties on each polymer.

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