

Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

T-Jump/FTIR Studies of Poly-Glycidyl Nitrate (PGN) Pyrolysis. CHAD STOLTZ, SUHITHI PEIRIS, Naval Surface Warfare Center, Indian Head Division — The nitrate-ester binder PGN (poly-glycidyl nitrate) has a high oxygen balance and density, making it one of the most energetic nitrate ester binder systems for potential use. However, when cured using aliphatic isocyanate curing agents it ages poorly, hindering its applicability for use in energetic formulations. Scientists have end-modified the polymer chains with moieties that contain primary –OH groups in an attempt to increase post-curing stability. In an effort to understand the effects of hydroxyl end-modification and isocyanate curing, decomposition of PGN prepolymer has been investigated using T-Jump/FTIR (Fourier Transform Infrared Spectroscopy) of PGN allowing real-time analysis of decomposition gas products under simulated deflagration conditions. Our results identify decomposition products including: CH₂O, H₂O, CO₂, CO, N₂O, NO, NO₂, HCN and HONO. Kinetic rates relative to CO₂ formation lead to calculated activation energies of 22 kcal/mol and 18 kcal/mol. Much higher activation energies (32 kcal/mol) were calculated relative to CH₂O formation rates, in agreement with DSC data, indicating that CH₂O formation is likely an initial decomposition step while CO₂ formation is due to side gas phase reactions. Additional FTIR and optical microscopy studies indicate that condensed phase, backbone scission reactions also occur, causing time delays prior to major gas production.

Chad Stoltz
Naval Surface Warfare Center, Indian Head Division

Date submitted: 23 Feb 2007

Electronic form version 1.4