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Comparison of shock-driven reactions in acrylonitrile and acetonitrile PETER GOODWIN, DANA DATTELBAUM, STEPHEN SHEFFIELD, Los Alamos National Laboratory — Shock-driven reactions in simple molecules often occur with densification along the reaction coordinate. Acrylonitrile (CH_2-CH-CN) and acetonitrile (CH_3-CN) are two simple molecules that undergo shock-driven reaction on the principal Hugoniot. Using in situ embedded electromagnetic gauging techniques and the LANL large bore two-stage gas gun, a three-wave structure was observed in acrylonitrile indicating that at least two higher density species are formed. The reaction cusp or threshold was determined to be ~ 4.8 GPa on the principal Hugoniot, and a series of experiments were performed above this condition to determine the state sensitivities of the reactions. The acceleration in reaction rate with shock input pressure (temperature) was found to be high, with a 5-fold increase in the rate over less than 2 GPa increase in shock input pressure. The global reaction rates were found to be similar to detonating high explosives. Time-resolved Raman spectroscopy was attempted to elucidate reaction species but it was found that the conditions became optically opaque even during the first wave. Acrylonitrile will be compared with acetonitrile, which despite having a similar chemical structure, has a higher reaction threshold. LA-UR-17-21553

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