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Role of microstructure and thermal transport in determining the rate of hot spot growth in aluminized PBX KAUSHIK JOSHI, SANTANU CHAUDHURI, Univ of Illinois - Urbana — The mechanisms of initiation and propagation of a hot spot in non-ideal explosives with aluminum additives are poorly understood due to greater complexity introduced by the different thermal and mechanical behavior of the components. In aluminized composites such as PBXN-109, the binder, RDX and Aluminum phases have been studied separately. However, not much is known about deflection of hot spots in the microstructured composite. Especially, the role of adhesion, debonding and thermal conductivity of binder phase is critical in moderating the sensitivity of such interfaces. Using reactive molecular dynamics simulations, the primary binder interfaces in PBXN-109 was investigated. Depending on the temperature of the growing hot spot reaching an RDX or Al/Al2O3 grain, the thermal conductivity and viscoplastic behavior of the binder interface determine the attenuation of reaction front and thermal shock leading the hot spot. Different mechanisms like melt-dispersion and failure of oxide layer for the release of Al in the hot spot regions remain underexplored to connect the chemistry to the microstructure. Although Al/Al2O3/RDX and Al/Al2O3/HTPB interfaces are chemically stable, the hot spot melts the AlxOy layers and create shear bands in aluminum domain due to thermomechanical strain created due to different thermal environment. In a shock-compressed microstructure without voids, the cohesive interaction and chemical composition of such interfaces for different phases of RDX will be presented.

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