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The Deflagration-to-Detonation Transition (DDT) in High Density Pentaerythritol Tetranitrate (PETN) PETER SCHULZE, IAN LOPEZ-PULLIAM, ERIC HEATWOLE, TREVOR FEAGIN, GARY PARKER, Los Alamos National Laboratory, M-6 EXPLOSIVES APPLICATIONS AND SPECIAL PROJECTS TEAM — The deflagration-to-detonation transition (DDT) is a mechanism by which explosives can transit from burning to detonating under suitable confinement and powder morphology conditions. The length that this transition is able to occur for specific explosives is an important safety consideration. The DDT length in Pentaerythritol Tetranitrate (PETN) has been studied extensively previously as PETN is a common explosive used in detonators. DDT has been observed to occur in PETN on length scales on the order of tens of millimeters for densities up to 1.56 g/cc, which is roughly 88% of its theoretical maximum density (TMD; for PETN: 1.778 g/cc). However, standalone pellets of pressed PETN commonly exceed 90% TMD. The DDT length versus density curve for PETN appears to approach an asymptote past 88% TMD, and so previous work cannot answer definitively whether or not higher-density PETN pellets will undergo DDT nor what run length is required for the transition. In this work, we explore the DDT reaction in 1.65 g/cc PETN (93% TMD). Two mechanisms for initiating a burn in the PETN are used: thermal ignition and piston driven ignition. The effect of confinement strength on the reaction progress is also explored by housing the PETN in three different tube materials: polycarbonate, sapphire, and steel. We find that confinement strength plays a major role in the ability of the PETN to undergo DDT.

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