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Live Imaging and Heating of Confined RDX and HMX Crystals Until Reaction Using the Dual Windowed Test Vehicle CHRIS STENNETT, Cranfield University, MALCOLM COOK, Syanco Ltd, PHILIP CHEESE, UK MoD, ANDREW WOOD, Syanco Ltd, NATHAN WHITE, TOM REEVES, UK MoD — A high fidelity live camera feed recording RDX and HMX crystals, measuring 1 mm thick and 15 mm in diameter, decomposing while heavily confined and subjected to various heating rates until a reaction occurs has been analysed. Video records reveal unexpected behaviour in both RDX and HMX crystals prior to ignition. Three distinct stages can be observed: phase changes and melting; slow, flameless decomposition with production of gaseous intermediates; and finally burning with a luminous flame of the gaseous intermediates. Tests with pure RDX and HMX crystals reveal pockets of gaseous materials forming above the molten and bubbling nitramine, before a flame appears at one side then burns inwards in an apparent conductive manner at a few metres per second. This causes the remaining bubbling nitramine to be compressed. Violent reaction appears to occur via a bubble collapse mechanism. The violence of this event is dependent on the loss of confinement; if it fails in the first or second phase the reaction is less violent than if the third phase is reached. The third phase burning reaction has associated pressure waves, which is presumed oscillation of the flame front, leading to wave interactions, pressure spikes and ultimately a violent reaction.

Chris Stennett
Cranfield University

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