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Influence of surface contamination on the microstructure and morphology of vapor-deposited pentaerythritol tetranitrate (PETN) films ERIC FORREST, ROBERT KNEPPER, MICHAEL BRUMBACH, KIM ARCHULETA, MICHAEL MARQUEZ, HY TRAN, ALEXANDER TAPPAN, Sandia National Laboratories — The field of Microenergetics relies on novel techniques to produce small-scale explosive samples for study of ignition, combustion, and detonation phenomena. Physical vapor deposition is one method to achieve precise control of explosive morphology and microstructure at length scales of interest. However, interfacial effects on morphology resulting from deposition processes are poorly understood, and can result in drastically different detonation behavior. In this study, we investigate the influence of substrate surface contamination on morphology and microstructure of vapor-deposited PETN films. Surface conditions are altered with various cleaning treatments, resulting in a range of oxide and contaminant profiles. Surface energy is quantified using a four-liquid contact angle measurement approach. Surface science techniques such as angle-resolved XPS enable study of surface constituents at Ångstrom length scales. Following deposition, PETN films are characterized using optical microscopy, scanning electron microscopy, and profilometry. Results demonstrate that substrate contamination at Ångstrom length scales has a profound effect on PETN microstructure and morphology, likely through influence over interface energy during the deposition process.

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