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Microwave frequency material properties and ignition predictions of neat and plastic bound explosives M. DAILY, S. SON, Purdue University, B. GLOVER, Los Alamos National Laboratory, L. GROVEN, Purdue University — Microwave energy has been considered for ignition, enhanced burning, and detection/defeat of energetic materials. However, the very limited data set of electromagnetic properties for both neat and plastic bound explosives has severely limited design and implementation of detection, defeat, and initiation devices. In this work, we report complex permittivity measurements for both neat and plastic bonded energetic materials such as HMX, RDX, PBX9501, etc. These measurements provide a new, more extensive set of self-consistent data that can be used to predict the response of such materials to electromagnetic energy. Using this data in conjunction with finite element analysis software, a high localized field experimental microwave applicator was designed and microwave heating predictions were calculated. Predictions show the feasibility of heating low-loss energetic materials in such cavities with high local electric fields without the need for susceptor particles. For the plastic bound materials, the effect of the binder is presented, showing that electromagnetic energy is preferentially absorbed in the more absorptive binder, resulting in significant gradients within individual energetic crystals (e.g., HMX crystals in PBX 9501). These predictions are now being used to aid experimental work with the applicator cavity and have demonstrated the feasibility of volumetrically heating energetic materials in short time scales with low microwave power levels.

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