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5P01 - High Speed Imaging of Polymer Bonded Explosives under Mechanical Stresses

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The impact of mechanical stresses on polymer bonded high explosives, HE, is investigated. High-Speed photography in the visible spectrum, VIS, as well mid-wave infrared (MWIR) of HE during small diameter drilling and controlled skidding is presented. Controlled drilling into the HE enables recording the size and temperature of shavings under varying feed and speeds. Even at very high drill speeds, the HE phase transition temperature of approx. 180 degree Celsius is rarely exceeded. The MWIR signals radiated are recorded with FLIR's X6901sc High-speed MWIR camera, which uses InSb technology, with a wavelength range from 3.0 to 5.0 μ m, and up to 1,004 fps at a resolution of 640 x 512 in the temperature range of interest. The physical shaving's path and size of the HE is recorded with Phantom's VEO710s high-speed camera at much higher frame rate of 7,400 fps at a resolution of 1280 x 800 in the VIS.

In the skidding case, the HE is pushed with measured force against a rotating surface with controlled roughness. The roughness of the impact area is determined by varying the type and surface density of distributed grit. While it is straightforward to observe the HE-grit interaction in the VIS by employing a glass or BK7 window as interface surface, the MWIR range poses a greater challenge as such glasses are opaque in the MWIR. Thus, for the temperature measurements the HE is skidded across a sapphire optical window. The window is chosen for its IR transparency up to 5.5 μ m wavelengths and mechanical toughness. Thus, the grit size and distribution is recorded in the VIS, while the MWIR provides information on the HE-grit interface temperature, which in the extreme case, leads to full or partial detonation of the HE.

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