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Triboluminescent Sensor for Detection of Impacts of Sub-millimeter Explosion Fragments[1] GEOFFREY CHASE, SAM GOROSHIN, DAVID L. FROST, McGill University — Fine metallic fragments in the millimeter and submillimeter size ranges may result from high-velocity impact with an obstacle or from explosive dispersal. The size, velocity, and spatial distribution of the fine fragments are difficult to determine with available diagnostic systems. A novel detector based on a high-sensitivity triboluminescent screen that is developed and described in this paper can, in principle, fill this niche. The light-generating impact screen utilizes a triboluminescent manganese-doped zinc sulfide (ZnS:Mn) powder. The polycrystalline bulk material is synthesized in-house using the self-propagating high-temperature synthesis reaction between sulfur and manganese. The multi-layered sensor screen is comprised of aluminum foil, a mono-layer of coarse polycrystalline particles, and transparent backing. The sensor is optically coupled to a photomultiplier via a fiber optic taper. The operation of the system is demonstrated by impacting the screen with spherical projectiles of different density in the 0.5–1.2 mm size range accelerated by a helium-driven light gas gun to speeds in the 0.2–1 km/s range.

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