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Polyurethane Based Molding Powder

Solvent-free PBX manufacturing method eliminates hazards, reduces waste, and enables tunable properties.

Researchers at Purdue University have developed a novel method for manufacturing polymer-bonded explosive (PBX) molding powder. Their innovation improves on traditional methods by eliminating the need for potentially harmful solvents and wasteful evaporation steps and saving time through a simplified manufacturing process. In addition, this new process does not rely on any of the PBX binders that frequently face sourcing issues due to limited manufacturing capabilities. By utilizing alternative binders, this new method will alleviate a major limiting factor in current PBX manufacturing. This novel process could also be superior to an existing alternative method in which thermoset slurries are created. The slurry method addresses some of the issues faced by traditional processes, but it generally requires a prohibitively large concentration of binder while delivering a PBX product with lower energy density. The novel method generated by Purdue researchers overcomes many of the issues currently facing traditional PBX manufacturing without the product limitations of the thermoset slurry method.

Technology Validation:

The novel method of manufacturing polymer-bonded explosive (PBX) molding powder was developed and streamlined to a set of key steps. Molding powders with 90 wt.% solids loading of sugar and a coarse (150-212 Î¼m) to fine (90-150 Î¼m) ratio of binder of 4:1 was tested. The characteristics of the new PBX molding powder and the final compacted PBX as a function of binder cure times prior to pressing were investigated. It was found that the length of the cure time impacts several physical characteristics, such as the distribution of the binder in the PBX compacts and the stiffness and texture of the pellets. Cure times around 8 hours were found to produce the most homogeneous pellets. The cure times ultimately impacted both the stiffness, the microstructure, and the macrostructure of the pellet.

Advantages:

Technology ID

2024-MCCL-70782

Category

Aerospace & Defense/Defense Electronics & Surveillance Technologies

Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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-Eliminates potentially hazardous solvents

-Less time-consuming than traditional methods

-Reduces manufacturing waste by eliminating evaporation steps

-Addresses current difficulties sourcing common PBX binders with limited availability

-Easily tunable properties based on slight adjustments to manufacturing process

-Simplified process is significantly easier than traditional manufacturing methods

Applications:

-Explosives

-Defense

-Weapons manufacturing

TRL: 4

Intellectual Property:

Provisional-Gov. Funding, 2024-09-19, United States

Utility-Gov. Funding, 2025-09-19, United States

Keywords: Materials and Manufacturing, Mechanical Engineering, molding powder, PBX, plastic bonded explosives, tunable microstructure