RAM Technology Provides Safer and Cheaper Manufacturing of Energetic Materials

Resonant Acoustic Mixing (RAM) Technology
Reduced Cost & Increased Safety of Energetics Production

PERIOD OF PERFORMANCE:
July 2014 to December 2022

PLATFORM:
Energetics / MK 152

CENTER OF EXCELLENCE:
EMTC

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STAKEHOLDER:
PEO (U&W), PMA-242

TOTAL MANTECH INVESTMENT:
$2,285,000

A2575 — Energetics Production Utilizing Resonant Acoustic Mixing (RAM)

Objective

A Resonant Acoustic Mixer (RAM) uses a novel mixing technology developed for the U.S. Army under a Small Business Innovation Research project that was patented in 2007. There have been subsequent laboratory-scale investigations of the technology at various labs throughout the Navy and Department of Defense (DoD). In the RAM, mixing is achieved by acoustical energy input to the material rather than mechanical mixing by moving blades. This means that, unlike current mixing, there are no moving parts in contact with the explosive material, which provides a significant safety advantage. Existing methods have the potential for friction initiation of energetic material if the blades and the bowl become off-set and make contact, or if foreign material enters the mixer and becomes lodged between the blades and bowl. This failure mechanism has resulted in past explosive incidents. Replacing mechanical mixing of energetics with resonant acoustic mixing would eliminate this safety hazard. The objective of the project was to develop and demonstrate a small munitions production process utilizing RAM-5 to mix the explosive fill.

Payoff

RAM technology offers a number of benefits as compared to current energetics mixing processes. Polymer-bonded explosive, PBXN-110, the explosive fill of the MK 152 warhead, is currently manufactured using planetary vertical mixers. RAM offers a number of benefits over vertical mixing.

As mentioned above, RAM provides a significant safety advantage over vertical mixing, and mixes much more quickly than conventional mixers. In addition, evaluation of the labor required for the proposed production process shows a cost reduction that, at current production levels, results in annual savings of $1M to MK 152 production, providing a 2.5-year return on investment. Additional savings would be achieved when the newly proven technology is used for other existing programs and new work. RAM also offers reduced footprint, new capabilities, and the potential to produce materials not easily processed using current mixing methods. Materials with higher viscosities and shorter pot lifes (solidification times) can be made.

Implementation

The successful completion of this Energetics Manufacturing Technology Center (EMTC) project will result in a fully operational RAM production facility at the Naval Surface Warfare Center Indian Head Division (NSWC IHD), as well as a qualified RAM production process for the MK 152 warhead to meet the Direct and Time Sensitive Strike Program Office's (PMA-242) requirements. Direct transition to full production is anticipated following successful first article testing.

Techniques and processes developed will support RAM programs elsewhere. Multiple DoD contractors have already expressed interest in partnering with NSWC IHD and utilizing the newly purchased RAM-5. Implementation is targeted for 2.75-inch insensitive munitions warheads, such as the MK 152 and MK 146. PMA-242 has signed a Technology Transition Plan to look at utilizing the RAM technology for full-scale manufacture.