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Energetics Manufacturing Technology Center

AMMONIUM DINITRAMIDE MANUFACTURING TECHNOLOGY

Objective

This project will develop the technology to reduce the manufacturing cost of ammonium dinitramide`(ADN) from between $3,000 and $5,000/lb to less than $100/lb. To achieve the objective the following will be accomplished: optimize the synthesis process for producing ADN to eliminate or significantly reduce the hygroscopicity, morphology, and thermal stability problems; develop processes for formulating and manufacturing propellants and explosives; develop pilot scale demonstrations of processes to manufacture propellants and explosives; and provide material and formulations that can be demonstrated in performance testing of rocket motors and explosives.

Benefits

ADN shows unique promise as a minimum smoke propellant ingredient compared to other current or projected energetic oxidizers. The use of ADN is expected to reduce rocket motor weight by approximately 40% and increase the specific impulse by 10%.

Applicable Weapon System

ADN is expected to have broad applications in propellants and explosives that are used for rocket motors and warheads such as tactical missiles, torpedoes, and a variety of ordnance devices.

Technical Approach

This project has two major tasks.

Task 1- production process optimization (with five subtasks); and

Task 2 - formulation process optimization (with three subtasks). It is subdivided into single year tasks that can be reviewed and modified as the work and progress dictate. Performance testing of a rocket motor and an explosive will be conducted as well.

Deliverables/Implementation

A goal of this program is to provide the necessary technology to allow the production of ADN, with controlled chemical characteristics, within 18 months of contract start. The results will be implemented at the contractor's plant to produce 100 pound lots of ADN.

Status

The engineering evaluation of the potential costs to synthesize relatively pure ADN suggests that there are two feasible routes for scale-up, although they both appear to be more expensive than the Bofors (Swedish) process. Work is ongoing to optimize the nitronium polysulfate route and improve the yield.

Crystallization, mechanical rounding, and precipitation techniques are not effective for producing larger particle ADN. Further exploration led to using a prilling process which converts a solid into spherical pellets by melting the feed stock (granular or crystalline substances) and allowing the molten drops to solidify while falling in the prilling tower. The result is a more free flowing material for use in propellant or explosive formulations. By using urea as an effective thermal stabilizer in conjunction with Cab-o-Sil as a processing aid and moisture barrier, acceptable ADN feed stock for the prilling process was produced.

A prototype prilling tower was constructed CONTRACTING OFFICER'S REP: and spherical ADN, which possesses superior processing and safety properties, was produced. Prill size is dependent upon feed particle size (morphology of the feed lot). Thus, throughput of acceptable material is dependent upon standardization of the feed stock and further work will be required before optimal rates can be achieved.

- Start Date: **September 1995**
- End Date: **October 2000**

Funding

- MANTECH Expenditures to Date: **$261,000**
- Estimate to Complete: **$3,124,000**

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