PHD THESIS ABSTRACT

"STUDIES AND RESEARCH REGARDING THE REUSE OF HIGH EXPLOSIVES AFTER THE END OF WEAPONS LIFE CYCLE"

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The folowing PhD thesis pertains to the field of "Mechanical Engineering" and addresses a topical issue at national and international levels, with possible applications both in the military industry and in the civil energetical materials industry.

In Chapter I the theoretical study on the current methods of delaboration / loading and recovery of explosives from explosive systems is carried out. This study highlighted the disadvantages of demilitarization technologies, the environmental impact of the destruction operations, and the need to develop a new method of recovering the energetical material from high explosive mixtures.

Chapter II presents polymerbindersused in highexplosive mixtures, thewellknown PBX explosive mixturesand energetic plasticizers used in the field of energetical materials. The most important disadvantage of modern explosive compositions is precisely the low solubility of common binders, which is why the recovery of explosives at the end of the munitions life cycle is a costly and dangerous process. Also, during the explosive recovery processes, their purity and morphology change.

In order to attempt to overcome the above disadvantages, a study has been carried out on the binders / adhesives currently used. Following this literature study on adhesive synthesis methods, it was concluded that the monomers most desirable to obtain an alkali soluble polymer binder are butyl acrylate, ethyl acrylate, ethylhexyl acrylate and acrylic acid.

The synthesis of polymeric binders and their physicochemical characterization are presented in Chapter III. Based on experimental research and interpretation of the results, a suitable polymeric binder was chosen to allow recovery of the energetical material from an explosive mixture, such as ethyl acrylate / acrylic acid (EtAc / AcA).

Experimental methods performed in the specializedlaboratories for obtainingthehighexplosive mixtureHMX-EtAc / AcA, the blending technology and the method of loading by pressing the explosive shell are presented in Chapter IV.

For the production and use of a new explosive mixture in different applications, it is necessary to characterize the physical, chemical and explosive properties (safety and performance) and a quasi-partial approval detailed in Chapter V. Analyzing the chemical properties, useful knowledge for identifying, establishing reactivity, and analyzing stability to predict the behavior of the mixture throughout its life cycle had been obtained. With the view to determining the explosive safety properties, the explosive mixture HMX-EtAc / AcA was subjected to specific analyzes to determine the sensitivity to vacuum (STANAG 4556), temperature sensitivity (STANAG 4491), impact sensitivity (STANAG 4489), sensitivity to friction (STANAG 4487) and sensitivity to electrostatic discharge (STANAG 4490). The explosive performance characteristics of HMX-EtAc / AcAhigh explosive mixtureweredeterminedexperimentally by determining detonation, shock and temperature sensitivity. Using the EXPLO5 program and the Jacobs-Cwperhwaite-Zwisler (JCZ3) and Becker-Kistiakowsky-Wilson (BKW) methods, the detonation parameters of the HMX-EtAc / AcA explosive mixture were determined for different binder ratios (5%, 10% and 20%).

Chapter VI is mainly concerned with the method of recovering the energetical material (HMX) from the explosive mixtureanditscharacterizationmethods.

Chapter VII is devoted to the final conclusions along with personal contributions to the current study.