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Development and Characterization of Energetic Formulations Incorporating Polyurea/Polyurethane Binders

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Abstract

In the contemporary context, drawing a clear line between internal and external security in current operations can be challenging, given the prevalence of asymmetric threats. Thus, armed forces and internal security institutions frequently perform similar duties, so both need a broad range of equipment and capabilities. For example, the inability of the defense troops to carry out highly complex night combat actions led to the development and use of pyrotechnic illumination systems and, subsequently, night vision equipment. These illuminating devices are generally developed to secure camps and protect borders. This research focused on developing heterogeneous mixtures used as pyrotechnic compositions in illumination systems. Thus, various composite formulations based on barium nitrate (as oxidizer), magnesium powder (as metallic fuel), and a polymeric binder (polyurethane/polyurea) were obtained and characterized through specific analytic investigations. The innovation of this research consists of environmentally responsible pyrotechnic formulations, incorporating a 'green' blend of polyester-polyols obtained from recycling polyethylene terephthalate waste. In addition, the polyurea/polyurethane binder will improve the processability of these energetic mixtures and minimize the risks associated with the manufacturing process. Both newly developed and conventional pyrotechnic compositions were comparatively analyzed to assess the improvements brought by the introduction of the binder, in terms of safety and performance.

Keywords: illumination, safety, processability, performance, binder, polyurea/polyurethane