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Thermal Decomposition of Mechanoactivated Ammonium Perchlorate

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Highlights:

- Regimes of non-explosive mechanoactivation of ammonium perchlorate are found
- Thermal decomposition temperature decreases by more than 100 °C
- Rapid release of oxygen at a temperature of 250-260 °C

Abstract –

The regimes of non-explosive mechanical treatment of ammonium perchlorate (AP) in high-energy intensity planetary ball mill are found. The changes in the structure and reactivity of AP as a result of mechanical processing were studied by methods of synchronous thermal analysis with registration of mass spectra, x-ray diffraction, microscopy and elemental analysis. Mechanical treatment reduces the particle size from 1000 μm to a fraction of μm and leads to formation of agglomerates of submicron particles with sizes of 5-10 μm. X-ray diffraction analysis shows the absence of the formation of new phases and a substantial broadening of the diffraction lines. As a result of mechanical activation, the temperature of AP thermal decomposition decreases by more than 100 ° C, accompanied by the rapid release of oxygen at temperatures of 250-260 ° C, immediately after the phase transformation in AP. The results obtained make it possible to explain the phenomenon of a significant increase in the detonation ability of mechanically activated AP and its mixtures with Al.

Keywords: mechanoactivation; ammonium perchlorate; thermal decomposition

1. INTRODUCTION

One of the effective ways to increase the burning and detonation rates of energetic materials based on metal and a solid oxidant is their mechanical activation (MA) in ball mills [1-5]. MA is accompanied by grinding and mixing of components with increasing effective contact surface of reagents, as well as the