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EXPERIMENTAL INVESTIGATION OF THE PRESSURE COUPLED RESPONSES OF COMPOSITE PROPELLANT WITH DIFFERENT AMMONIUM PERCHLORATE PARTICLES SIZE

Abstract

In recent years, some of the full-scale tactical motors adopting aluminized composite propellants have experienced strong combustion instability. A starting point is to work with ammonium perchlorate (AP) composite propellants because of their long history and continuing interest for the foreseeable future .Furthermore, the longitude mode instabilities of motors containing AP composite propellants present the most challenging in stability problem. During the research and development process of a tactical motor, two kinds of aluminized AP/HTPB composite propellants of different formulations were used (the AP particle size are different), whereas, whose behaviors were different. The purpose of this work was to understand the combustion response of propellants of different AP particle size is being investigated by T-burner.

Based on the T-burnerthis paper designed the pulser and adopted Double-Pulsing test method for comparing the pressure coupled response of the two kinds of the aluminized composite propellant A and B, which loading of 61 percent of multimodal AP. But there is one important difference, the propellant A contains 10 percent of fine AP particle (about 5-10μm) and contains 3 percent of ultra-fine AP particle (<1μm), whereas propellant B contains 15 percent of fine AP particle (about 8-10μm) and without ultra-fine AP particle. According to the acoustics model of the tactical motor, test frequency were 255Hz and 150Hz.The operating pressures of experiments were 7.5MPa, and obtain different decay constant (alphas1 and alphas2) and grow constants (combustion alphas) about the two kinds of propellants.

The result shows that the distribution sizes of the AP particles in the propellant are different and make the pressure coupled response of the two samples are different. For the propellant A sample the alphas1, alphas2 and combustion alphas were -10.16,-14.63 and 2.33 sec-1, respectively, and the computed response function for this sample test was 0.47. For the propellant B sample the alphas1, alphas2 and combustion alphas were -15.4,-31.33 and 9.1 sec-1, respectively, and the computed response function for this sample test was 1.61.

The experiments results show that the propellant with more fine AP particles were more likely to induce combustion instability, and made the propellant combustion more unstable. This results of the experiments in the T-burner are very good agreement with the full-scale motors. Thus the percent of fine AP particles should be used with caution.