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RESEARCH ON MECHANISM FOR HIGH NOZZLE CLOSURE OPENING PRESSURE OF SOLID ROCKET MOTOR IN STAGE SEPARATION

Abstract

The success of launch missions depends critically on the stage separation. Stable ignition of Solid Rocket Motor plays an important role in cold separation. With high nozzle closure opening pressure, SRM is easy to get a steady millisecond ignition delay time. Hence, to assess the stability of ignition, a series of experimental and simulation studies on the stability of high nozzle closure opening pressure has been carried out. It is observed that the opening pressure of the aluminum nozzle closure bonded to the expansion section of the nozzle is effectively controlled, with minimal fluctuations (7.19/7.28/ 7.28/7.46/7.17 MPa) during the test. Furthermore, damage form of the nozzle closure can be precisely controlled. The results indicate that the aluminum nozzle closure exhibits performance compared to the alternative materials. Moreover, the implementation of the cohesive zone model in the simulation calculations accurately predicts the nozzle closure opening pressure. The results obtained from present study paves the way for designing a nozzle with a consistently optimal opening closure pressure that can be tailored to the specific needs of the rocket, offering enhanced control and reliability.