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## Experiments on the Characteristic of the Nonlinear Combustion Response Functions of Solid Propellants

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**Abstract:** In order to obtain the characteristics of nonlinear pressure coupling response of solid propellants, a method for measurement of the nonlinear pressure coupling response function of solid propellants was established. The nonlinear pressure coupling response functions of three formulations of aluminum propellants were obtained. The characteristics of the nonlinear pressure coupling response of propellants were also analyzed in detail. It indicates that with increase of the trigger pressure, higher-order frequency oscillations can be excited and the amplitude of nonlinear oscillation could be larged as well. By triggering at the both ends of the chamber, the oscillation is dominated by the longitudinal first-order frequency, but when triggering in the chamber middle, the oscillation is dominated by the longitudinal second-order frequency. The nonlinear pressure coupling response function is sensitive to the amplitude of the oscillation, whereas the response value near the peak frequency is the most sensitive to the change of the amplitude of the oscillation. The response value is significantly different between the second-order frequency by triggering in the chamber and the first-order frequency by triggering at end of the half-length chamber. This result just verifies the method of the linear and nonlinear methods are different.

**Key words:** solid rocket motor; nonlinear combustion instability; solid propellant; combustion response; T-burner experimental measurement

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