

Analysis of Mechanical Properties for AP/HTPB Solid Propellant under Different Loading Conditions

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Abstract : To investigate the characterization of the mechanical properties of composite solid propellant (CSP) based on hydroxyl-terminated polybutadiene (HTPB) at different temperatures and strain rates, uniaxial tensile tests were conducted over a range of temperatures $-60\text{ }^{\circ}\text{C}$ to $+76\text{ }^{\circ}\text{C}$ and strain rates 0.000164 to 0.328084 s^{-1} using a conventional universal testing machine. From the experimental data, it can be noted that the mechanical properties of AP/HTPB propellant are mainly dependent on the applied strain rate and the temperature condition. The stress-strain responses exhibited an initial yielding followed by the viscoelastic phase, which was strongly affected by the strain rate and temperature. It was found that the mechanical properties increased with both increasing strain rate and decreasing temperature. Based on the experimental tests, the master curves of the tensile properties are drawn using predetermined shift factor and the results were discussed. This work is a first step in preliminary investigation the nonlinear viscoelasticity behavior of CSP.

Keywords : AP/HTPB composite solid propellant, mechanical behavior, nonlinear viscoelastic, tensile test, strain rate

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