

SPACE PROPULSION SYMPOSIUM (C4)
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EFFECT OF PRESTRAIN ON DYNAMIC MECHANICAL PROPERTIES OF HTPB PROPELLANT

Abstract

In order to understand how prestrain affect the dynamic mechanical properties of composite solid propellant, the accelerated aging tests of HTPB (hydroxy-terminated polybutadiene binder) propellant under the interaction of thermal and prestrain were carried out at 343K. The dynamic mechanical parameters of HTPB propellant at different prestrain levels were obtained through dynamic mechanical analyzer, including temperature spectra of storage modulus, loss modulus and loss factor. The results show that the dynamic mechanical properties of HTPB propellant are greatly influenced by the prestrain during the aging process. At the same aging time, with the increase of the prestrain, the flexibility of HTPB polymer chain decreases, as a result, the glass transition temperature of HTPB propellant increases. At the same time, the activation energy of the glass relaxation activation and the mechanical loss increase. Under the condition of aging with 15% prestrain level, with the increase of aging time, the mechanical loss of HTPB propellant increases, because the damage of binder matrix and the damage of interface between AP filler and matrix plays a leading role in the mechanical loss of the propellant. While for the propellant without prestrain, with the increase of aging time, the mechanical loss of HTPB propellant decreases due to the leading role of the oxidative crosslinking reaction of binder matrix.