

## Low Temperature Accelerated Aging Study of Propellant Charge in Structural Tester

CAO Fu-qi<sup>1</sup>, LI Xiao-huan<sup>1</sup>, LIU Zhi-cheng<sup>2</sup>, LI Yan-li<sup>3</sup>, YUN Sheng<sup>3</sup>

(1. China Airborne Missile Academy, Luoyang 471009, China; 2. Air Force Military Representative Office in Baotou, Huhhot 010010, China; 3. The 46th Institute of the Sixth Academy of CASIC, Huhhot 010010, China)

**Abstract:** In low temperature accelerated aging test method, using maximum tensile strength ( $\sigma_m$ ) and maximum elongation ( $\varepsilon_m$ ) under uniaxial stretching conditions as aging propellant characteristic parameters, the characteristic changing trend of propellant with different strain level in structural tester at  $-28\text{ }^\circ\text{C}$  was studied. Results indicate that the main reason of the aging of propellant with strain is due to the stress damage under low temperature. The dynamic mechanical analysis (DMA) test validates that the damage of the propellant happens. The  $\sigma_m$  of the propellant increases and the  $\varepsilon_m$  is waved with time gradually under normal temperature tension tests with the stretching speed of  $100\text{ mm}\cdot\text{min}^{-1}$ , and the test temperature ( $23\pm 2$ )  $^\circ\text{C}$ . And after 19 weeks low temperature aging, the  $\sigma_m$  of 15% strain structural tester was increased by nearly 30%. The  $\sigma_m$  of the propellant increases and  $\varepsilon_m$  was decreased greatly with time change under low temperature tension test with stretching rate of  $500\text{ mm}\cdot\text{min}^{-1}$  and ( $-55\pm 2$ )  $^\circ\text{C}$ . And after 19 weeks low temperature aging, the  $\sigma_m$  of 15% strain structural tester increases by nearly 11% and the  $\varepsilon_m$  decreases by nearly 29%. The ageing mechanism of propellant with strain under low temperature may be physical damage due to the effect of stress or strain, including net cohesion damage and the interface dewetting between solid grains and binder.

**Key words:** propellant; aging; strain; damage; mechanical properties

**CLC number:** TJ55; V512

**Document code:** A

**DOI:** 10.11943/j.issn.1006-9941.2015.07.008



### 《含能材料》“观点”征稿

为了丰富学术交流形式,及时传递含能材料领域同行们的学术观点和思想,《含能材料》开设了“观点”栏目。“观点”栏目的来稿应观点鲜明、内容新颖、形式上短小精悍。欢迎含能材料各领域的专家积极来稿。来稿时请附个人简介及主要研究工作介绍。

《含能材料》编辑部