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Numerical Simulation of Slow Cook-off Characteristic for AP/HTPB Composite Solid Propellant

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Abstract: To research the thermal safety problem of AP/HTPB composite solid propellant under the action of thermal loading, a two-dimensional simplified model about cook-off of solid rocket motor was established. Among them, the process of slow cook-off for AP/HTPB propellant was described by using two-step global reactions. The theoretical calculation results were in good agreement with the experimental data. On this basis, the numerical predictions of slow cook-off behavior for the motor were conducted at heating rates of 1.8, 3.6 K·h^{-1} and 7.2 K·h^{-1}, respectively. Results show that with different of heating rates, the initial ignition locations of AP/HTPB propellant are occurred in the annular region on the inner wall of the propellant at the longitudinal distance of about 1 mm, and the initial ignition location moves from the central to the grain shell end surface with the increase of heating rate. When the heating rate increases from 1.8 K·h^{-1} to 7.2 K·h^{-1}, the ignition temperature increases from 592 K to 595 K, revealing a little temperature change, but the ignition delay time shortens from 31.48 h to 14.87 h.

Key words: AP/HTPB solid propellant; thermal safety; slow cook-off; numerical simulation
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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。

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