

## Performance of Powder Propellant Based on AP Pretreatment Technology

WU Guan-jie<sup>1</sup>, REN Quan-bin<sup>1,2</sup>, HU Chun-bo<sup>1</sup>, MA Shao-jie<sup>1</sup>, LIU Lin-lin<sup>1</sup>

(1. National Key Laboratory of Combustion, Flow and Thermo-structure, Northwestern Polytechnical University, Xi'an 710072, China;

2. The Fourth Academy of CAS, Xi'an 710025, China)

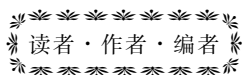
**Abstract:** The ammonium perchlorate (AP) powder was coated and agglomerated to improve the powder propellant surface properties, which provided the conditions for Al/AP propellant long-term storage and high efficiency combustion. The energy characteristics of Al/AP powder rocket motor were calculated by Gibbs minimum free energy method, and the effects of the hydroxyl-terminated polybutadiene (HTPB) to AP powder on the loading density, hygroscopicity, and thermal decomposition were analyzed by pretreatment experiments. The ignition tests were conducted in the closed burner to study the effect laws of *O/F* and packing quality to the energy characteristic parameters of Al/AP powder propellant. The results show that, the optimal material ratio of AP pretreatment is 10% HTPB, and in this circumstance, the theoretical specific impulse of Al/AP powder rocket engine can be up to a maximum of 262.1 s at 3 : 1 of *O/F*. The energy characteristic parameters of powder propellant will increase with the growth of *O/F* in a certain range; the gas generating quality of powder propellant per unit mass is basically equal at the same *O/F*, and both combustion temperature and velocity characteristics will increase with the growth of packing quality.

**Key words:** Al/AP powder propellant; hygroscopicity; thermal decomposition characteristics; ignition and combustion characteristics

**CLC number:** TJ55; V512

**Document code:** A

**DOI:** 10.11943/j.issn.1006-9941.2017.08.002



### 《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