

Title

Design, Fabrication and Performance of Planar Solid Propellant Micro-thruster Based on SU-8 Photoresist

Authors

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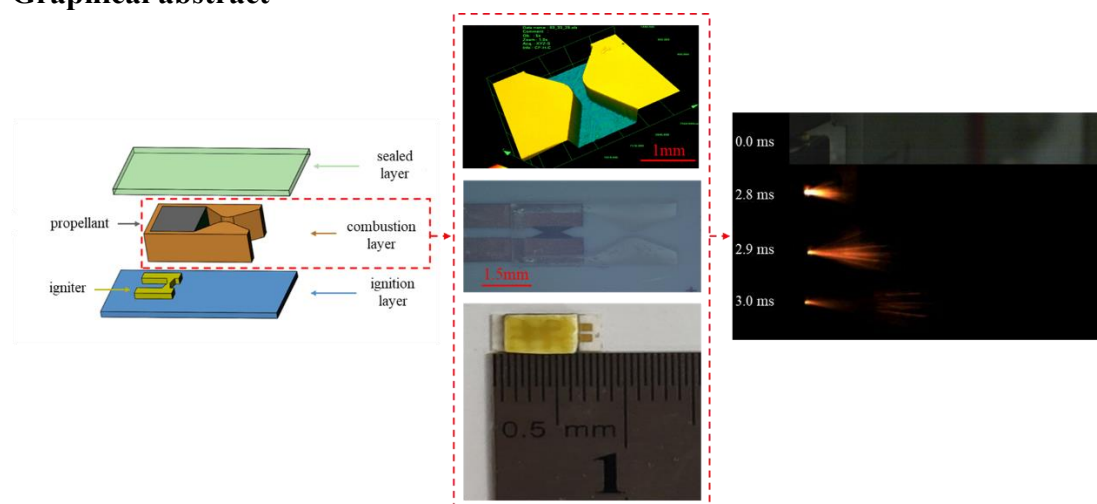
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Abstract

In order to meet the demand of small satellites for micro propulsion system, a Planar Solid Propellant Micro-thruster (PSPMt) was designed and fabricated. Using SU-8 photoresist as chamber material, a miniature combustion chamber with laval nozzle was fabricated with lithography technology. And the effects of coating, soft-bake, exposure and developing parameter on lithography result was also studied. The PSPMt was sealed with MD130 glue and its propulsive performance was tested by a micro-impulse testing platform. The results show that increasing the soft-bake time in an appropriate amount is helpful to eliminate the interfacial difference caused by the second coating. Insufficient exposure can easily cause swelling. And insufficient development time results in large line width deviation. The optimal lithography parameters used to prepare combustion chamber with SU-8 photoresist are obtained. The optimal exposure time is 25 s, and the optimal development time is 30 min. The impulse of the prepared PSPMt reaches 127.9 $\mu\text{N}\cdot\text{s}$ and its ignition duration lasts 0.2 ms when loaded with 1.9 mg nanothermite.

Graphical abstract



A Planar Solid Propellant Micro-thruster (PSPMt) was designed and fabricated using SU-8 photoresist as chamber material. The miniature combustion chamber with laval nozzle was fabricated by lithography technology and the optimal lithography parameters used to prepare combustion chamber with SU-8 photoresist were obtained. The PSPMt was successfully worked with impulse of 127.9 $\mu\text{N}\cdot\text{s}$.