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Hypersonic Air-breathing and Combined Cycle Propulsion, and Hypersonic Vehicle (7)

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RESEARCH ON THE EFFECT OF ASYMMETRIC AIR INTAKE ON THE MIXING AND  
COMBUSTION OF SOLID RAMJET

**Abstract**

To broaden the flight envelope of the ramjet, it is inevitable to face the problems of stage transfer and large angle maneuver. Affected by the attack angle and the sideslip angle, the operation of air inlet will deviate from the design state in large maneuver flight conditions, which will result in the asymmetric of air flow parameters, and then affect the combustion organization of the solid rocket ramjet consequently. Therefore, the effects of attack angle and sideslip angle on the flow characteristics of the air inlets were analyzed for a solid ramjet firstly, and the flow properties of the air inlets under maneuvering flight conditions were obtained. The mass flow ratio of the two air inlets is used as the asymmetry parameter. Then the test ramjet was designed based on the asymmetric mass flow in the air inlets. The direct connection tests of ramjet under different asymmetric flow conditions were carried out, and the influence of asymmetric air intake on the combustion efficiency of the combustor was further obtained. The results show that the combustion efficiency of solid ramjet first increases and then decreases with the increase of air flow asymmetry of two air inlets. within a certain range, it is beneficial to strengthen the mixing of the air and the fuel-rich gas in the combustor under asymmetry air flow in two air inlets, and then improve the combustion efficiency of the ramjet. However, with the further increase of the mass flow ratio of the two air inlets, the mixing between the air and fuel-rich gas in the combustor becomes obviously uneven, and the combustion efficiency of the ramjet will be reduced significantly.