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RESEARCH ON THE SCHEME AND HOT FIRE TESTS OF COMBUSTION DEVICES FOR 100KN LOX/METHANE ROCKET ENGINE

Abstract

The propellant combination of LOX/methane has the merits of extensive source, low cost, innocuity, high density specific impulse, good cooling characteristic, a little coking and close boiling point. LOX/methane rocket engine could be a good choice for reusable launch vehicle and space vehicle in future. Development of LOX/methane rocket engine was described, the characters were analyzed, and the application prospect was looked forward.

In recent years, 100kN LOX/methane rocket engine, with vacuum thrust of 100kN, vacuum specific impulse of 3450m/s and combustion chamber pressure of 8.0MPa, was researched in China. The rocket engine adopts fuel-rich gas generator cycle system and use cartridge igniter and cartridge starter to start-up. The thrust chamber and gas generator both use cartridge igniter to ignite.

Researches on hot fire tests of the gas generator and the thrust chamber were completed. The rationality of design scheme and the feasibility of ignition procedure were proved, and the key technology of ignition and combustion for LOX/methane combustion devices was solved.

The fuel-rich gas generator, with liquid-liquid combustion, was composed with head and body. The head was composed with coping, injector and cartridge igniter, and the cartridge igniter was in the center of the head. The body adopt regenerative cooling, with methane cooled. Four hot fire tests of the gas generator were carried out, ignited reposefully and combusted stably. The tests indicated that, for the LOX/methane fuel-rich gas generator, the ignition procedure of ignition hot gas, oxidizer and fuel enter into the combustion chamber in turn was feasible. The gas generator organized good combustion within a wide range of pressure and mixture ratio, and had the characteristic of good temperature uniform and a little coking.

The thrust chamber was composed with head, combustion chamber and short nozzle, adopt regenerative cooling and film cooling, with methane cooled. A hot fire test of the thrust chamber was carried outand obtained stable parameters. The test indicated that, for the LOX/methane thrust chamber, the ignition procedure of ignition hot gas, fuel and oxidizer enter into the combustion chamber in turn was feasible. The thrust chamber could organize good combustion in the test condition.