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STUDY OF THERMAL CHOCKING IN THE EXPANDING RBCC COMBUSTOR

Abstract

Expanding combustor has been validated to realize the best performance of the RBCC engine which has several operating modes. But it is based on the implementation of thermal chocking in the duct which was influenced by several factors including expanding angle, heating increment and heating law etc. Theoretic analysis, CFD and experiment study were carried out in order to know how to generate thermal chocking. We amended the existing one-dimensional RBCC combustor analysis model with the handy experimental data and form a new model which was described in detail in this paper. A new combustor was designed based on the analysis of these factors mentioned above by the amended model to make sure thermal chocking would generate in the duct. Finally, the new RBCC combustor model was validated by experiments on RBCC engine test facility. It is concluded by the amended one-dimensional analysis that the expanding angle, heating increment and heat release law are of crucial effect on the thermal chocking. These effect factors mainly influence the position of chocking throat, the total pressure loss and the distribution of the temperature. In order to implement thermal chocking in the duct, there must be a certain heat release law, heating increment and a specific range of expanding angles which depend on the given heating law. The CFD results match well with that of the new one-dimensional analysis. The new experimental data of the new RBCC combustor agree with the results from the above one-dimensional and CFD analysis in a certain degree, which validates the feasibility of the amended one-dimensional RBCC combustor analysis model. This optimizing methodology, which includes amending one-dimensional analysis model and verifying the result by CFD analysis, could facilitate the implementation of thermal chocking in the RBCC combustor.