

Accepted Manuscript

Effects of injection nozzle exit width on rotating detonation engine

Jian Sun, Jin Zhou, Shijie Liu, Zhiyong Lin, Jianhua Cai

PII: S0094-5765(17)30868-8

DOI: [10.1016/j.actaastro.2017.09.008](https://doi.org/10.1016/j.actaastro.2017.09.008)

Reference: AA 6459

To appear in: *Acta Astronautica*

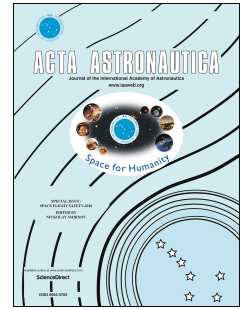
Received Date: 26 June 2017

Revised Date: 30 August 2017

Accepted Date: 6 September 2017

Please cite this article as: J. Sun, J. Zhou, S. Liu, Z. Lin, J. Cai, Effects of injection nozzle exit width on rotating detonation engine, *Acta Astronautica* (2017), doi: 10.1016/j.actaastro.2017.09.008.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Effects of injection nozzle exit width on rotating detonation engine

Jian Sun¹, Jin Zhou², Shijie Liu³, Zhiyong Lin⁴, Jianhua Cai⁵

Science and Technology on Scramjet Laboratory, National University of Defense
Technology, Changsha 410073, China

Abstract: A series of numerical simulations of RDE modeling real injection nozzles with different exit widths are performed in this paper. The effects of nozzle exit width on chamber inlet state, plenum flowfield and detonation propagation are analyzed. The results are compared with that using an ideal injection model. Although the ideal injection model is a good approximation method to model RDE inlet, the two-dimensional effects of real nozzles are ignored in the ideal injection model so that some complicated phenomena such as the reflected waves caused by the nozzle walls and the reversed flow into the nozzles can not be modeled accurately. Additionally, the ideal injection model overpredicts the block ratio. In all the cases that stabilize at one-wave mode, the block ratio increases as the nozzle exit width gets smaller. The dual-wave mode case also has a relatively high block ratio. A pressure oscillation in the plenum with the same main frequency with the rotating detonation wave is observed. A parameter σ is applied to describe the non-uniformity in the plenum. σ increases as the nozzle exit width gets larger. Under some condition, the heat release on the interface of fresh premixed gas layer and detonation products can be strong enough to induce a new detonation wave. A spontaneous mode-transition process is observed for the smallest exit width case. Due to the detonation products existing in the premixed gas layer before the detonation wave, the detonation wave will propagate through reactants and products alternately, and therefore its strength will vary with time, especially near the chamber inlet. This tendency gets weaker as the injection nozzle exit width increases.

¹ Ph.D. Student, E-mail: 506096226@qq.com.

² Professor, E-mail: zj706@vip.sina.com, Corresponding author.

³ Associate professor, E-mail: lsjudt@gmail.com.

⁴ Associate professor, E-mail: linzy96@nudt.edu.cn.

⁵ M.S. Student, E-mail: caijianhua.1993@163.com.

Download English Version:

<https://daneshyari.com/en/article/5472128>

Download Persian Version:

<https://daneshyari.com/article/5472128>

[Daneshyari.com](https://daneshyari.com)