

Technical Comments

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Reply by the Authors to W. H. Heiser

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IN our recent paper [1], we intended to clarify the basic characteristics of thrust and detonable-gas-based specific impulse of partially filled pulse detonation rocket engines, rather than to discuss the benefits of partial filling on the increase of the specific impulse. We included the term “Rocket” in the title of the paper because the oxidizers in the present calculations were not necessarily supposed to be air.

The comments of Heiser are sound from the integrated viewpoint of aerospace propulsive devices. Nevertheless, it should be noted that not only detonable gas but also inert gas, the amount of which is not

negligible, has to be supplied to the combustor in a pulse detonation engine in each cycle. This inert gas is the purge gas preventing the fresh detonable gas from igniting by the heat of the hot burned gas of the previous cycle. This inert gas does not necessarily result in the performance loss, but rather contributes to the thrust to some degree. This degree of contribution can be estimated by Eq. (7) of [1].

Our recent experiments show that, when the pulse detonation rocket engine (PDRE) operates in an atmospheric condition, the engine’s specific impulse always increases due to the effect of the partial filling. These experimental results are almost identical to Eq. (7) of [1]. Under the multicycle operation in such a finite backpressure condition, the burned gas of the previous cycle can play a role as the tamper gas in the partially filled tube. From the above, it can be concluded that the effect of partial filling on PDRE performance may be expected under an atmospheric condition.

References

- [1] Sato, S., Matsuo, A., Endo, T., and Kasahara, J., “Numerical Studies on Specific Impulse of Partially Filled Pulse Detonation Rocket Engines,” *Journal of Propulsion and Power*, Vol. 22, No. 1, 2006, pp. 64–69.

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