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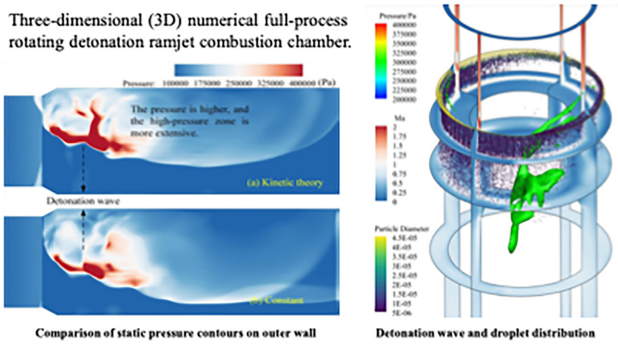
Two thermal property calculation methods provide reference for the selection of combustion chamber parameters during simulations.



The kerosene-fueled, two-phase rotating detonation ramjet is a new type of aerospace engine with a high thermodynamic cycle efficiency. Studies thus far have mainly focused on characterizing the process of two-phase spray in the cold flow field. However, there has been no published numerical description of the detonation flow field in the engine's combustion chamber.

To this end, Yan et al. used thermal property calculation methods to establish a 3D numerical model for a two-phase rotating detonation ramjet combustion chamber based on the Euler-Lagrange simulation method. They applied kinetic theory and the constant thermal physical property parameter (TPPP) method to calculate dynamic viscosity and thermal conductivity, respectively. The influences of these different methods on the flow field parameters and operating characteristics of the two-phase ramjet model were then investigated.

To accurately characterize the physicochemical properties of kerosene as a mixture, $C_{12}H_{23}$ was used as a kerosene substitute. In addition, the Kelvin-Helmholtz Rayleigh-Taylor (KH-RT) model was employed to simulate the breakup of droplets. The results demonstrate that the constant TPPPs method can be used when $C_{12}H_{23}$ droplet fragmentation is considered using the KH-RT model, resulting in the acceleration of the propagation speed of the two-phase detonation waves.

In the near future, the researchers will consider the impact of modifying the fragmentation model to improve the accuracy of the numerical simulations.

"The results in this paper will provide the necessary theoretical guidance for designing the kerosene-fueled rotating detonation ramjet engine and its combustion chamber," said co-author Wei Lin. "In addition, we hope to advance the progress of engineering applications of rotating detonation ramjet engines."

Source: "Influences of thermal physical property parameters on operating characteristics of simulated rotating detonation ramjet fueled by $C_{12}H_{23}$," by Chenglong Yan, Chen Shu, Jiafeng Zhao, Lingyu Su, Yiheng Tong, Qiaofeng Xie, and Wei Lin, *AIP Advances* (2022). The article can be accessed at https://doi.org/10.1063/5.0101939.