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Numerical investigation of the detonation wave characteristics of boron-based gel propellant

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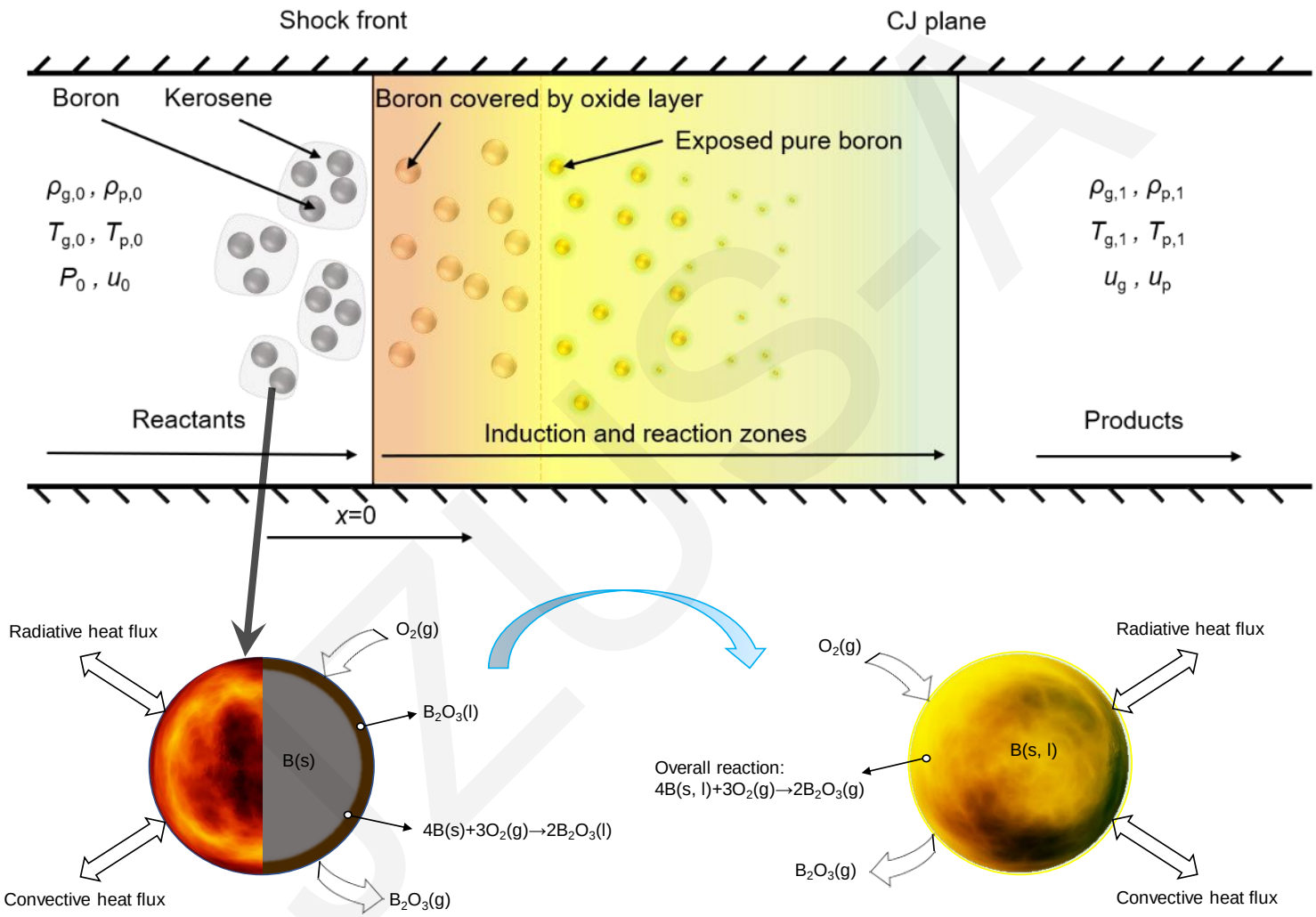
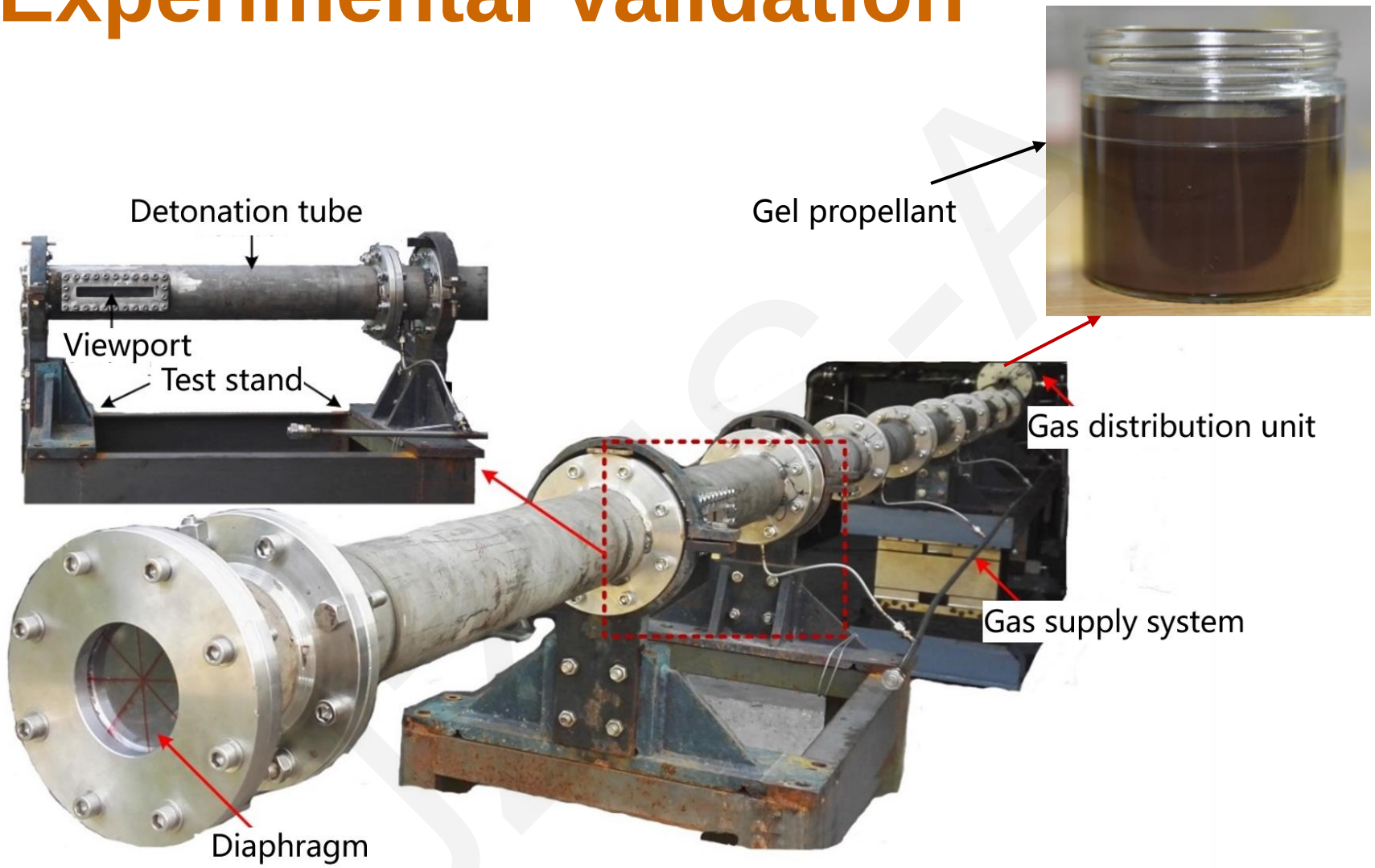
Physical Model



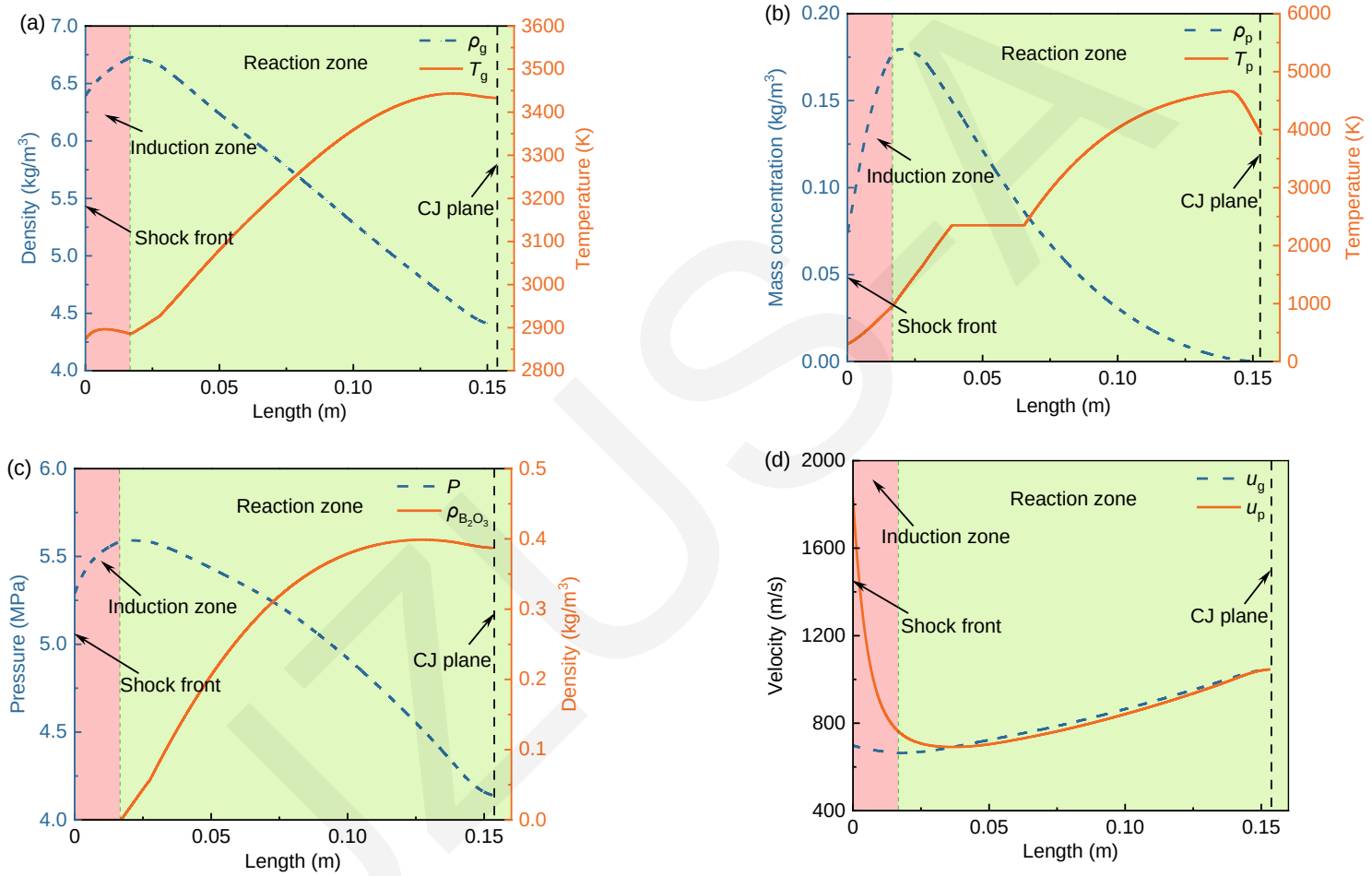
Based on the ZND model, a 1D steady-state detonation wave structure of a gel propellant is depicted.

Experimental Validation



Experimental validation is carried out, in which a gel propellant with 40% boron content was prepared and then tested in a detonation tube.

Results and Discussion



The distribution of the gas phase and particle phase densities, velocities, and temperatures, oxidation product density, and detonation pressure in the detonation wave flow field are obtained

Conclusions

- In this study, a detonation wave model of boron-based gel propellant was established. The model was validated by comparing the peak pressures of the detonation wave obtained by numerical simulations and ground tests. The results show that the peak pressure of the detonation wave can reach 6.15 MPa, and the model exhibits a maximum deviation of 8%. Upon iterative calculations, the eigenvalue detonation velocity of a boron-based gel propellant under default working conditions was obtained as 1831.5 m/s.