Abstract Submitted
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On the Possibility of Condensation during Supercritical Fuel Injection[1] LU QIU, ROLF REITZ, University of Wisconsin-Madison — Supercritical fuel injection into a nitrogen environment was simulated using Peng-Robinson equation of state. The real gas simulation was found to match the experimental injectant density much better than the ideal gas simulation, emphasizing the importance of applying realistic equation of state model. Possible fuel condensation processes were also investigated by considering the stability of the single phase by utilizing fundamental thermodynamics principles. Several conclusions from the experiments are also seen from the simulations. First, though both the injection and chamber pressures are above the critical pressure of the injectant, condensation can become possible as long as their temperature difference is large enough, and when this occurs, the fluid is able to enter the two-phase region. Condensation is found to be enhanced when the chamber temperature is further reduced, indicating that the fluid is in a state further away from the phase border. In addition, the newly formed condensed phase is found to exist only in the jet boundary where there are strong interactions between the "hot" injectant and the "cold" nitrogen. Finally, it was concluded that the local strong heat and mass exchange sent the mixture into the two-phase region by crossing the dew point line with the commencement of condensation.

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