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Simulation studies on cooling of cryogenic propellant by gas bubbling

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Injection cooling was proposed to store cryogenic liquids (1,2). When a non-condensable gas is injected through a liquid, the liquid component would evaporate into the bubble if its partial pressure in the bubble is lower than its vapor pressure. This would tend to cool the liquid.

Earlier works on injection cooling (1,2,3) analysed the cooling process by considering instantaneous mass transfer and finite heat transfer between gas bubble and liquid. Based on the discrepancy between the experimental and simulated data in these works, it is felt that bubble dynamics (break up, coalescence, deformation, trajectory etc.) should also play a significant role in liquid cooling. Hence in this work, we propose a lumped parameter model assuming single bubble and considering both heat and mass interactions between bubble, liquid and the surroundings. This model can be used to study the effects of injection temperature, injection flow rate, orifice diameter, and gas and liquid properties on cooling performance.

References:

1. Larsen P. S., Randolph W. O., Vaniman J. L., and Clark J. A., Cooling of cryogenic liquids by gas injection. Advances in Cryogenic Engineering. Vol. 8. K. D. Timmerhaus, ed., Plenum Press, p 507, 1962.
2. Schmidt A. F., Experimental Investigation of liquid-hydrogen cooling by helium gas injection. Advances in cryogenic Engineering. Vol. 8. K. D. Timmerhaus, ed., Plenum Press, p 521, 1962.
3. Cho N., Kwon O., Kim Y., Jeong S., Investigation of Helium Injection cooling to liquid oxygen propellant chamber, Cryogenics, vol. 46, p 132, 2006.

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