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C2Po1F-04 [34]: Effect of Curved Rigid Surface on The Collapsing Cavitating Bubble in Cryogenic Environment

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To study the dynamically changing interfacial structures due to the collapse of the cavitating bubble, and the mechanism whereby forces large enough to cause damage are brought to bear against a rigid wall is of great importance in the study of cavitation induced erosion, and, still somewhat obscure in cryogenic liquids. Study of individual collapsing bubbles and resulting microjet during the collapse is still a cornerstone to understand the erosive damage process. Though, the preliminary mechanism of cavitation induced erosion is not clear yet. The high impact pressure resulting from jet water hammer effect and collapsing shock waves has advantages in stone fragmentation, shock wave lithotripsy, but carry damage potential also and can erode the curved hydrofoil, and alter the blade profile of any turbo-machinery. Subsequently, once the material loses its surface smoothness, the flow-field surrounding the collapsing cavitating bubbles is affected by the newly formed irregular surface geometry. In this way, the bubble collapse is significantly influenced by the curvature of the rigid boundary.
Therefore, in this paper, a collapsing cavitating bubble near a curved rigid surface dipped in cryogenic fluid has been investigated numerically to illustrate the effect of different surface configurations (i.e. convex and concave) using volume-of-fluid (VOF) method in a compressible framework for a fixed standoff distance. Here, different jet characteristics, i.e. jet velocity, movement of the bubble centroid and shock effects etc. have been evaluated to quantify the damage, and the results obtained are compared with the room temperature fluid combination i.e. air-water.

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