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Design and Countermeasures against Cavitation in a Downstream Conduit of the Liquid Lithium Target for International Fusion Materials Irradiation Facility

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A liquid-lithium (Li) free-surface stream flowing under a high vacuum serves as a Li target for the planned International Fusion Materials Irradiation Facility (IFMIF). As the primary Japanese activity for the Li target system of the IFMIF/EVEDA (i.e. Engineering Validation and Engineering Design Activities) project, implemented under the Broader Approach (BA) Agreement, cavitation-like acoustic noise was reported in the downstream conduit of Li target assembly (TA) of the IFMIF/EVEDA lithium test loop (ELTL), which aims to verify the lithium target and purification systems envisioned the IFMIF. To clarify the cause of this acoustic noise, we found that acoustic emissions due to cavitation occurred in a narrow area near the start of the bend pipe where the Li target impinged by using acoustic-emission sensors. And the method to determine this conflict (initial arrival) location was formulated. Intermittent high-frequency acoustic emission can also cause of the cavitation-erosion crack of the structural materials due to cavitation bubbles collapse (cavitation pitting). To examine the detailed location of the cavitation-like acoustic noise occurring in the downstream conduit of TA, the change of initial arrival position in the downstream conduit according to the velocity of Li target was calculated by the flow analysis of ANSYS/Fluent V16.2 and SCRYU/Tetra, and the design and countermeasures against this type of cavitation were discussed.

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