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# Lead Bismuth Free Surface Target for High Intensity Proton Beam Application

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A Lead-bismuth cooled accelerator driven system (ADS) is considered as a promising option for the transmutation of long lived nuclear waste into short lived or stable isotopes. In this type of reactor a subcritical core is used receiving the required neutrons for the nuclear reaction by spallation using a high power proton beam from an accelerator. At the entry point of the reactor pool where the beam impinges on the surface of the liquid metal, which simultaneously acts as the target material, special construction effort is indispensable to handle the high heat production.
In order to demonstrate the ADS concept, the Multi-purpose hybrid Research Reactor for High-tech Applications (MYRRHA) is currently under design at Mol/Belgium. One of the proposed targets for this reactor is a free surface target, based on a ring like liquid metal curtain, converging into a liquid metal jet by surface tension effects, and thus forming an inner and an outer free surface. The inner surface is then subjected to the 2.4MW proton beam, while the curtain maintains the separation between beam line and reactor pool.
A near full scale prototype of this target design has been set up and experimentally investigated at the Karlsruhe Liquid Metal Laboratory (KALLA) at the Karlsruhe Institute of Technology (KIT). Measurements at different flow rates of up to 30m³/h show a stable surface in a wide range of operating conditions. In addition, the exact inner and outer shape of the conical surfaces were detected by image processing and depth of field information. Comparison with numerical precalculations using commercial CFD code Star-CD and Star-CCM+ show a very good agreement of experimental and numerical data.

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