

Long Range Optical Distance Sensors for Liquid Metal Free Surface Detection

Björn Brenneis*

Karlsruhe Institute of Technology, Germany

**Corresponding author: bjorn.brenneis@kit.edu*

For the demonstration of Fusion power plant technology, DEMO dedicated materials are necessary to cope with the harsh environment of high-energy neutrons. For this purpose, the international neutron irradiation facility for fusion materials IFMIF/DONES (DEMO oriented neutron source) is planned to be built in Granada, Spain. A deuteron beam hitting the lithium target produces a high energy neutron flux. Due to the high-power density, the windowless target is a free surface liquid lithium flow on a concave backplate. In order to keep the heat released by the beam within the liquid lithium and to avoid its introduction in the backplate a stable configuration of the free surface flow with a setpoint layer thickness of 25 ± 1 mm is crucial. Especially stable wave structures, so called wakes, which occur from accumulated impurities at the nozzle edge, can cause a critical local decrease in the layer thickness of more than one mm. Therefore, it is necessary on the one hand to better understand the nature of these wakes and on the other hand to be able to monitor the surface profile to shut down the beam in case of a critical thickness loss but to avoid unintended shut-down.

The focus of this work are lab experiments with GaInSn and simulations in Blender of two selected optical sensors for their capability of measuring distances on liquid metal. The results showed a significant dependency of the measurement result and the waviness of the liquid metal surface. Nevertheless, it was possible to resolve the wavy liquid metal surface with a sufficient resolution to detect critical wake structures.

Keywords: DONES, liquid metal, optical distance sensors

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.