



Contribution ID: 200

Type: Talk

HBS High Power Density Neutron Target - An approach to meet the special requirements of HiCANS

Thursday, 23 March 2023 11:15 (15 minutes)

Within the framework of the Jülich High Brilliance Neutron Source (HBS) project, a high current accelerator based neutron source (HiCANS) is developed. The main power-limiting factor is the target that releases neutrons via nuclear reactions from the impinging protons. The neutron yield of these nuclear reactions is quite small. This is compensated with a high proton current which leads to a strong heat release inside the target. At the same time the target has to be very compact. Overall, this leads to unique requirements of the HBS target given by a 70 MeV pulsed proton beam on a surface area of 100 cm² with a peak current of 100 mA and an average thermal power release of 100 kW inside the target. A solid tantalum target prototype with an innovative micro channel water cooling structure was developed, manufactured, and tested at 1 kW/cm² with an electron beam to match these requirements. Known challenges from low energy targets like blistering, joining, lifetime, and heat dissipation, as well as particular challenges of the HBS target design like coolant erosion, thermomechanical stresses, and critical heat flux have been consequently considered during the development.

Here, we will present the HBS target design, explain various measures taken to solve the challenges mentioned, and show the successful high heat flux tests in the electron beam facility JUDITH 2.

This work is part of the collaboration within ELENA and LENS on the development of HiCANS.

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Session Classification: Micro Symposium CANS 2

Track Classification: Micro-Symposium CANS