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HBS Neutron Target Development

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High-Current Accelerator-driven Neutron Sources (HiCANS) have been established as a promising option for a new generation of neutron sources. Within the framework of the high brilliance neutron source (HBS) project a powerful HiCANS is developed to serve as a user facility. One of the key components as well as a particular challenge is the development of a neutron target since it is the main power-limiting factor of this type of facility. This target releases neutrons via nuclear reactions from an impinging proton beam with energies well below the spallation threshold. The quite small neutron yield of these nuclear reactions is compensated by a high current. The unique requirements specified for the HBS neutron target are given by a 70 MeV pulsed proton beam with a peak current of 100 mA, an average thermal power of 100 kW on a target area of 100 cm² and a desired lifetime of about one year.
A solid tantalum target prototype with an innovative micro channel water cooling structure was developed, manufactured, and successful tested at operation conditions with an electron beam as well as destroyed in order to experimentally examine the targets limit. 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.

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