

High-current accelerator-based neutron sources – Fusion materials and testing

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The neutron damage of structural materials in fusion reactors is a crucial challenge. Present knowledge of the accumulated neutron doses and neutron fluxes indicates that new materials need to be developed and experimentally proved. For this purpose neutron source facilities for material tests are strongly required. They have to be capable of offering (i) continuous irradiation to get required accumulated dose of neutrons and (ii) pulsed irradiation relevant to test the inertial-energy fusion regime.

High-current accelerator-based neutron sources rely on pulsed proton beams with tens of milliamp proton current and energies of several tens of MeV. This kind of non-fission neutron sources have been developed, and main components have been tested in recent years offering the path to neutron fluences comparable to fission reactors for irradiation and material testing purposes as requested by fusion materials.

We will present and discuss the options of high-current accelerator-based neutrons sources like the HBS project and similar neutron facilities discussed to offer the fusion community access to required neutron beams to develop and test fusion materials e.g. of lead blanket sub-assemblies or breeding blankets, and to solve important challenges in the design, construction and operation of such facilities.

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