Framework of Collaboration Investigation on Neutron Effect on Superconducting Magnet Materials

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The importance of the investigation on neutron irradiation effect increases as D-D or D-T burning plasma devices are designed and the construction proceeds in the world. To confirm the neutron irradiation field and test facility to carry out the evaluation of superconducting properties after irradiation, a new collaboration framework has been established in Japan. The outline of the frame is show in Fig. 1. Researchers working in magnet system, superconducting engineering field, materials engineering field, neutronics field, fission reactor engineering field and so on are gathered. Industries support the framework by making the samples which are irradiated at FNS or JRR-3 in JAEA up to fixed neutron fluence and sent to High Field Laboratory in IMR at Katahira campus for the test at high magnetic field up to 27 T in liquid helium.

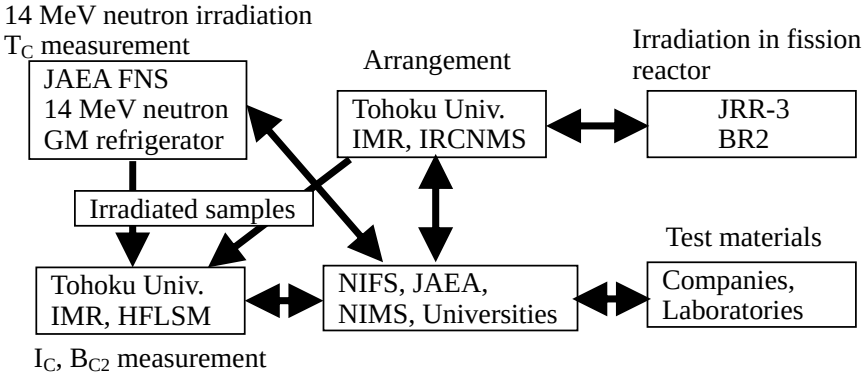

Fig.1 Collaboration scheme for research on neutron irradiation effect.

The measured critical current of Nb_3Sn after irradiation is shown in Fig. 2. The Ic increased after 1.78 x 10^{21} n/m^2 neutron irradiation but the critical magnetic field did not change remarkably. It is considered that the knock-on effect of the fast neutron will produce the vacancies and interstitials resulting in the improvement of Ic by enforcing the pinning force and /or increasing the number of the pinning sites.

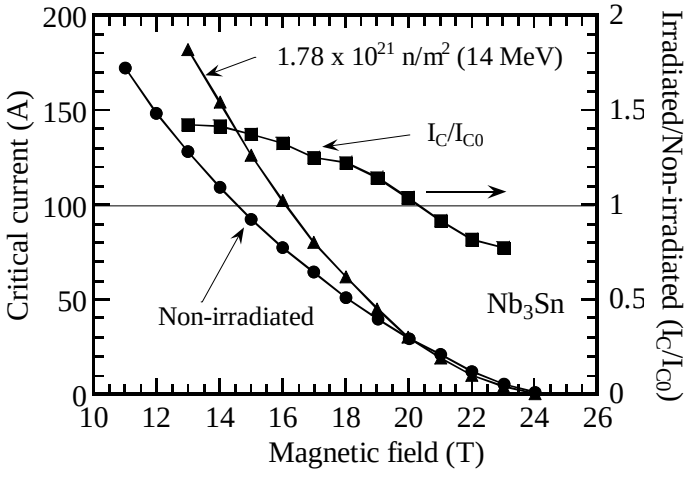

Fig.3 Change in critical current of Nb_3Sn wire against magnetic field after 14 MeV neutron irradiation.