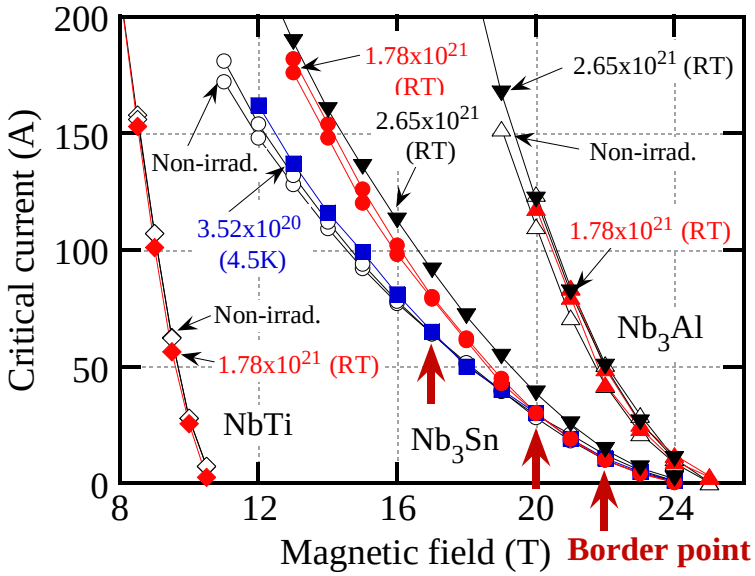
Neutron Irradiation Effect on Critical Current of Superconducting Wires

超伝導線材の臨界電流に及ぼす中性子照射効果



14 MeV neutron irradiation was carried out at Fusion Neutron Sources in Japan Atomic Energy Agency. The neutron fluence of 2.65 x 10^{21} n/m^2 was achieved and the Nb_3Sn strand showed significant change in the critical current. When the neutron fluence increased, the critical current (I_C) in the lower field increased remarkably and a border point where I_C of the irradiated sample was away from I_C curve of the non-irradiated sample moved to the high field side. Pinning force would be strengthened by the irradiation damage but the long range ordering was disturbed at the same time resulting in the decrease of the critical temperature.

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Reference: A. Nishimura, T. Takeuchi, S. Nishijima, K. Ochiai, G. Nishijima, K. Watanabe, T. Shikama, “14 MeV neutron irradiation effect on critical current and critical magnetic field of Nb_3Sn and Nb_3Al wires,” Advances in Cryogenic Engineering, Vol. 56 (2010) pp. 255-262.

14 MeV 中性子照射を日本原子力研究開発機構の核融合中性子源施設で実施した。最大照射量は 2.65 x 10^{21} n/m^2 で、Nb_3Sn 素線が顕著な臨界電流の変化を示した。中性子照射量が増えると低磁場側の臨界電流の増加が大きく、未照射素線の I_C 曲線から照射材の I_C が離れる点は次第に高磁場側に移動する。ピン止め力が照射損傷によって強化されているものと考えられ、同時に長範囲規則性の低下によって臨界温度が低下している。

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