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Ongoing efforts at internal-tin Nb3Sn strand with higher Jc and lower Qh for fusion application

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After mass production for ITER, Western Superconducting Technologies, Co. Ltd. (WST) still takes great efforts at internal-tin (IT) Nb3Sn strand with higher Jc and lower Qh, for next generation of fusion reactors, such as DEMO in Europe and CFETR in China. Three routes, i.e. Cu split, Sn spacers and 37 subelements were carried out to obtain such strand, based on the structure and process of IT Nb3Sn strand for ITER. The route of Cu split was discovered to be most efficient to decrease Qh, which could be as low as 300 mJ/cm3, 30% lower than the average of ITER IT Nb3Sn strand. Nevertheless Jc was also reduced to about 900 A/mm2, 10% lower than the ITER average due to the loss of Nb area by inputting Cu split. Sn spacers between outermost subelements enhanced Jc to about 1100 A/mm2 without obvious increase of Qh, though Sn spacers could be quite harmful to the deformation of Ta barrier. Jc of strand with 37 subelements could reach 1100A/mm2, about 20% higher than the average Jc of ITER IT Nb3Sn strand, and Qh could be as low as 400 mJ/cm3. This strand was delivered to EPLF, Switzerland to fabricate experimental conductor sample for DEMO.

Submitters Country

China

Primary authors: Dr LIU, Jianwei (Western Superconducting Technologies, Co. Ltd.); Dr ZHANG, Ke (Western Superconducting Technologies, Co. Ltd.); Mr SHI, Yigong (Western Superconducting Technologies, Co. Ltd.); Dr LI, Jianfeng (Western Superconducting Technologies, Co. Ltd.); Prof. LIU, Xianghong (Western Superconducting Technologies, Co. Ltd.); Prof. FENG, Yong (Western Superconducting Technologies, Co. Ltd.); Prof. ZHANG, Pingxiang (Western Superconducting Technologies, Co. Ltd.)

Presenter: Dr LIU, Jianwei (Western Superconducting Technologies, Co. Ltd.)

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