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M1Or2A-05: Workability and recrystallization behavior of Nb-Ta, and Nb-Ta-Hf alloys

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Recent advances in Nb3Sn to meet the very demanding FCC specification of Jc greater than 1500A/mm2 (4.2K, 16T) has led to the development of an Nb-Ta-Hf alloy, which has indicated high layer Jc's of 3700A/mm2 are possible. This high Jc translates to a non-Cu Jc of 2200A/mm2 in an RRP® configuration. The reason for this high Jc (16T,4.2K) is because the irreversibility field of (Nb-Ta)3Sn is unaffected due to the additions of Hf to an Nb-Ta alloy and due to the formation of ultra-fine grain (UFG) Nb3Sn. The mechanism of formation of UFG Nb3Sn is intricately related to microstructure in the Nb-Ta-Hf alloy during the reaction heat treatment stages. To realize the promise of Hf additions, and make a magnet conductor workability of Nb-Ta-Hf up to large strains needs investigation. In this study we investigate the workability of Nb-Ta-Hf restack multi-filaments to true strains beyond 10, and compare them with the base Nb-Ta alloy. Given the relevance of the microstructure in the alloy rod during the Nb3Sn reaction we also compare the recrystallization behavior of the heavily drawn Nb-Ta, and Nb-Ta-Hf conductors. Results of multi-filament conductor drawing have been performed up to a strain of 7, and no intermediate breaks have been observed. Recrystallization behavior of Nb-Ta-Hf alloy at a strain of 7 indicates significant grain growth occurs only beyond 750℃, whereas grain growth is observed at 600℃ in the corresponding Nb-Ta conductors.

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