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[Invited] Prospects for further improving J_c of Nb_3Sn conductors

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The record J_c of Nb_3Sn conductors has plateaued since the early 2000s; however, new target has been put forward for the planned future circular colliders. This presentation aims to discuss prospects for further improvement of Nb_3Sn conductors. The factors determining the non-Cu J_c are summarized, which include current-carrying Nb_3Sn fraction in subelements, Nb_3Sn Bc_2 , and pinning capacity; then prospects to improve each factor are analyzed respectively. A model is introduced for phase fractions in subelements; the limit of current-carrying Nb_3Sn fraction in subelements is obtained based on this model. A model is also proposed to explore what determines Nb_3Sn phase stoichiometry during diffusion reaction. It is seen that among all the possible means, the only opportunity for significantly improving non-Cu J_c relative to the present record values lies in improving pinning. To improve pinning, a comprehensive review of an internal oxidation technique is given in this talk, including its opportunities, challenges, and its applications in major types of Nb_3Sn wires (PIT, RRP, and single-barrier wires). Recent progress in optimizing this method for further improving the performance of Nb_3Sn conductors is also reported.

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