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M3Or3J-02: [Invited] APC Nb₃Sn conductors: opportunities and challenges

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In the past few years a new type of Nb₃Sn strand with artificial pinning centers (APC) has demonstrated significantly superior performance relative to the state-of-the-art Nb₃Sn conductors. Such APC strands are based on the internal oxidation method, which generates nano-size ZrO₂ or HfO₂ particles (mostly 1-10 nm) in Nb₃Sn. It was found that this method improves high-field J_c via four mechanisms: (1) the particles directly serve as flux pinning centers (point pinners), (2) the particles refine Nb₃Sn grain size, (3) the flux pinning force (F_p-B) curve peak shifts to higher fields, (4) the irreversible field (B_{irr}) is enhanced. In 2019 the APC conductors we developed first reached the non-Cu J_c specification required by the 16 T dipole magnets for the proposed Future Circular Collider (FCC). Since then our efforts have been mainly focused on pushing the APC strands toward readiness for practical applications, and great progress has been made. In this talk a review of the APC Nb₃Sn conductors will be given, including their opportunities, challenges, recent progress, and future plans.

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