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Recent progress on APC in multi-filamentary Nb₃Sn wires¹

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Internal oxidation technique could generate nano oxide particles in Nb₃Sn strands, which could significantly refine the Nb₃Sn grain size and boost the high-field critical current density. Our recent APC (Artificial Pinning Center) Nb₃Sn wires with Ta and Zr doping demonstrated substantial grain refinement and significantly increased $J_{c,nonCu}$, while retaining the high B_{c2} values of the best ternary Nb₃Sn conductors. The non-Cu J_{cs} of these APC conductors has reached nearly 1500 A/mm² at 16 T/4.2 K, which achieve the current CERN FCC target. Their layer J_c reaches 4700 A/mm² at 16 T/4.2 K - more than double the present best ternary Nb₃Sn conductors. Their B_{c2} was about 28 T, about 1-2 T higher than present state-of-the-art conductors. Microscopy analysis shows that this APC wires still have overly high residual Nb fractions due to the low Sn/Nb ratio, indicating that there is still great potential for further $J_{c,non-Cu}$ improvement. This strand has been made to 61-filament restack strands getting filament size of 45 micros at the 0.5 mm strand.

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