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## Shift of the Fp-B curve peak of Nb<sub>3</sub>Sn conductors with very fine grain sizes

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In an earlier work we demonstrated on a monofilament that the internal oxidation method can significantly refine the grain size and improve the high-field  $J_c$  of Nb<sub>3</sub>Sn strands. In that work we found that as the Nb<sub>3</sub>Sn grain size was reduced down to 20-50 nm (with an average of 36 nm), the peak of the Fp-B curve shifted from 0.2Birr to 0.34Birr. In this work we further reduce the grain size by using a lower reaction temperature and a higher-Zr Nb-Zr alloy, in order to find out how the Fp-B curve peak shifts as grain size decreases. A pinning theory is also developed to explain the shift of the Fp-B curve peak as grain size is reduced. In this work we also work towards implementing the internal oxidation method in practical multi-filamentary tube type Nb<sub>3</sub>Sn strands. Schemes to apply this method to rod-restack-process (RRP) and powder-in-tube (PIT) strands are also proposed.

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