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M2Or4B-01 [Invited]: Thick Film REBCO Tapes with High Critical Currents in High Magnetic Fields

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An Advanced Metal Organic Chemical Vapor Deposition (A-MOCVD) process has been developed to fabricate REBCO tapes with critical currents over 6200 A/12 mm (engineering current density (J_e) = 5200 A/mm²) at 4.2 K, 15 T which is 7X the J_e of commercial REBCO tapes and 5.4X the J_e of best Nb₃Sn tapes. Such high performance is due to the excellent growth of 4 – 5 μm REBCO thick films and embedded nanoscale defects of density of about 10,000/μm². By modifying the defect density, a critical current of 1440 A/cm has been achieved at 65 K, 1.5 T (B perp. tape). Flux pinning characteristics in these thick films has been investigated over 65 – 4.2K and 0 – 14T and correlated to the film composition and microstructure. 2D-X-ray Diffraction (2D-XRD) is used as a valuable metrology tool to rapidly screen the thick REBCO films for size and alignment of nanocolumnar defects as well as an in-line quality control system in Advanced MOCVD to produce consistent high-performance REBCO tapes.

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