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M1Or1A-02 [Invited]: Development of BMO Doped REBCO Coated Conductors with Homogenous In-field Properties by Productive Hot-Wall PLD Process

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In order to overcome the narrower deposition windows and less longitudinal homogeneity for high in-field performance BaMO₃ (M : Zr or Hf etc.) doped REBCO film, we applied hot-wall type pulsed-laser-deposition (PLD), which realized quite homogeneous crystalline growth conditions for REBCO by furnace-like substrate heating without spoiling productive throughput.
We studied growth condition dependence of BMO nano-rod structure, and *J_c* (B, theta, T) properties. Clear growth rate dependence were observed for c-axis correlated flux pinning properties and the shape and densities of nano-rod structure which should be affected by adatom migration durations. Though the minimum *J_c* (theta) of those samples were not so different at the temperature over ~30 K, the difference increased gradually at lower temperatures. The minimum *J_c* (theta) increased up to four times bigger for low growth rate samples of 5-7 nm/sec, as two-times for high-growth rate samples of 20-50 nm/sec, than non-doped REBCO films, at 4.2 K, 15 T.
The temperature and field dependent scaling properties were also studied for pinning force densities at the field configuration parallel to c-axis. The results indicated that strong c-axis correlated pinning could be only observed in low growth rate samples, where high-growth rate samples of >20 nm/sec had quite simple scaling properties similar to non-doped samples.
We finally optimized the deposition parameters so that they contribute to both good productivity with high growth rate of 20-50 nm/sec, and less angular dependent and large enough in-field Ic properties which agree to *J_c*-B scaling law in wide temperature and field range. Production samples of 300-600 m long were routinely fabricated and test samples of 1 km long class also produced with good *I_c* uniformity comparable to non-doped REBCO wires. *I_c* uniformity was examined by scanning Hall probe microscopy (RTR-SHPM), and also end-to-end transport measurement in magnetic fields, etc. A part of this work is based on results obtained from a project subsidized by the New Energy and Industrial Technology Development Organization (NEDO).

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