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$YBa_2Cu_3O_{7-\delta}$ on MgO films grown by pulsed organometallic beam epitaxy and a grain boundary junction application

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MgO films and $YBa_2Cu_3O_{7-\delta}$/MgO multilayer films were developed with the pulsed organometallic beam epitaxy (POMBE) growth technique, and grain boundary junctions were fabricated from the films to demonstrate the utility of the multilayers. High-quality MgO films were grown on $LaAlO_3$ substrates by POMBE using a $Mg(dpm)_2$ precursor. MgO crystallinity, as assessed by x-ray diffraction rocking curves, improved with the use of CuO_x or $YBa_2Cu_3O_{7-\delta}$ buffer layers. $YBa_2Cu_3O_{7-\delta}$ films grown on the MgO layer by POMBE exhibited a T_{c0} of 83 K and a J_c (12 K) exceeding 10^6 A/cm^2 for applied magnetic fields up to 3×10^4 G. Grain boundary junctions were formed by growing $YBa_2Cu_3O_{7-\delta}$ on MgO films that had been pretreated with a simple sputtering technique. This sputtering induces a controlled, 45° grain boundary in subsequently deposited $YBa_2Cu_3O_{7-\delta}$ films. The resulting boundary showed weak-link current-voltage behavior and an I_cR_n product of 52 μV at 10 K, demonstrating that sputter-induced grain boundary junctions are compatible with multilayer technology.

Keywords: Chemical vapor deposition (CVD); Crystallographic structure; Superconductors
Materials: $YBa_2Cu_3O_{7-x}$/MgO

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