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Growth Mechanism of $EuBa_2Cu_3O_{7-\delta}$ Whiskers and Their superconducting properties for Intrinsic Josephson Junction Applications¹ A.T.M. NAZMUL ISLAM, T. KAWAE, Y. TACHIKI, S. WATAUCHI, Y. TAKANO, T. HATANO, T. YAMASHITA, I. TANAKA — We have grown Eu-123 single-crystal whiskers by annealing of precursor pellets containing Ca and Te. Microstructural and compositional analysis was performed on the longitudinal cross-section and the area of origin of a whisker to elucidated some aspects of the growth mechanism from bulk precursor. Sub-micron sized junctions fabricated by focus ion-beam etching on Eu-123 whiskers showed clear multi-branch with hysteresis structure in the I-V curve, which suggest excellent crystalline quality both of as-grown and high pressure annealed whiskers. We have also doped Er and Tm having a smaller ionic radius in single crystalline whiskers of (Eu, R)-123 (R = Er, R)Tm) and observed that Eu-rich whiskers, which require higher temperature to be grown, are more susceptible to oxygen deficiencies and structural instabilities. Our results shows that the carrier doping can be systematically controlled from highly underdoped to slightly overdoped range by suitable choice of average ionic radius of rare-earth elements in as-grown whiskers. The critical current density J_c of a Eu-123 whisker (T_c=45K) was estimated to be 1.43×10^5 A/cm² at 4.2K, twice as much as observed for Y-123 having a similar T_c .

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