Crystal growth of superconducting materials La$_{2-x}$Ba$_x$CuO$_4$

GENDA GU, J.S. WEN, Z.J. XU, J.M. TRANQUADA, BNL — Since the discovery of the superconductivity in high temperature superconducting oxide La$_{2-x}$Ba$_x$CuO$_4$ in 1986, a large number of groups have attempted to grow the single crystals. However, no single crystal La$_{2-x}$Ba$_x$CuO$_4$ with $x>0.11$ has been successfully grown. In this project, the effects of the growth condition and the compositions of a feed rod on the crystal growth of La$_{2-x}$Ba$_x$CuO$_4$ has been studied by an infrared image floating zone method. The experimental result shows that a planar solid-liquid growing interface tends to break down into a cellular interface when the growth velocity is more than 1 mm/h. When the planar solid-liquid growing interface break down into a cellular interface, the single crystal size decreases abruptly and the as-grown rod is not single phase. The large single crystals of La$_{2-x}$Ba$_x$CuO$_4$ with $x=0$ to 0.165 has been successfully grown. The single crystals of La$_{2-x}$Ba$_x$CuO$_4$ with $x=0$ to 0.165 up to 6 mm diameter and 150 mm length have been grown. The superconductivity transition temperature $T_c$ of as-grown single crystals of La$_{2-x}$Ba$_x$CuO$_4$ ($x=0$ to 0.165) have been measured.

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