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Large and high-quality single-crystal growth of cuprate superconductor Bi-2223 using the traveling-solvent floating-zone (TSFZ) method[1]
SHINTARO ADACHI, TOMOHIRO USUI, KENTA KOSUGI, NAE SASAKI, Hirosaki University, KENTARO SATO, MASAKI FUJITA, Tohoku University, KAZUYOSHI YAMADA, KEK, Japan, TAKENORI FUJII, University of Tokyo, TAKAO WATANABE, Hirosaki University — In high superconducting transition temperature (high-T_c) cuprates, it is empirically known that T_c increases on increasing the number of CuO_2 planes in a unit cell n from 1 to 3. Bi-family cuprates are ideal for investigating the microscopic mechanism involved. However, it is difficult to grow tri-layered Bi-2223, probably owing to its narrow crystallization field. Here, we report improved crystal growth of this compound using the TSFZ method under conditions slightly different from those in an earlier report [J. Cryst. Growth 223, 175 (2001)]. A Bi-rich feed-rod composition of $Bi_{2.2}Sr_{1.9}Ca_2Cu_3O_y$ and a slightly oxygen-reduced atmosphere (mixed gas flow of O_2 (10%) and Ar (90%)) were adopted for the crystal growth. In addition, to increase the supersaturation of the melts, we applied a large temperature gradient along the solid-liquid interface by shielding a high-angle light beam using Al foil around the quartz tube. In this way, we succeeded in preparing large ($2 \times 2 \times 0.05 mm^3$) and high-quality (almost 100% pure) Bi-2223 single crystals.

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