§77. Fiber Addition Effect to High-Tc Bulk

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High-Tc superconductor (HTS) is expected to be used for various fields applications. For example, it will be applied to large capacity current leads in a field of a certain energy system. The HTS is a ceramic and naturally mechanically brittle. Therefore, fracture by an electromagnetic force will become an essential problem. There is a fiber-reinforced -method to improve mechanical properties of structural ceramics. This method will be applicable to improve the mechanical property of HTS.

In this study, several kinds of fibers, Al_2O_3, $ZrO_2 \cdot Y_2O_3$, ZrO_2, SiC, were added to BPSCCO bulks, and a fiber addition effect was investigated by measuring of their super -conductive properties.

The fiber added BPSCCO (fiber/BPSCCO) samples were made by a solid state reaction as follows: BPSCCO-calcined powder and short fibers were mixed by a ball mill. The mixed powder was pressurized and formed to cylindrical pellets with 20 mm diameter and 6 mm thickness. These pellets were CIP-treated and sintered at 1113 K for 90 ks in an electric furnace. The BPSCCO bulk sample (no-fiber) was fabricated under the same sintering conditions as a reference.

Results of superconductive properties of the fiber/ BPSCCO samples and the no-fiber BPSCCO sample at 77 K are shown in Fig. 1. The ZrO_2 fiber added BPSCCO sample (ZrO_2/BPSCCO) and the SiC fiber added BPSCCO sample (SiC/BPSCCO) do not show any superconductive properties. The Al_2O_3 fiber added BPSCCO sample (Al_2O_3/BPSCCO) and the $ZrO_2 \cdot Y_2O_3$ fiber added BPSCCO sample ($ZrO_2 \cdot Y_2O_3$ /BPSCCO) are superconductive, and their superconductivity is inferior to the no-fiber BPSCCO sample.

The magnetization properties of the fiber/BPSCCO samples and the no-fiber BPSCCO sample are shown in Fig. 2. All samples including those which do not show superconductive are diamagnetic below 100~110 K.

Electrical insulation materials or phase might be formed during the sintering process in fiber/BPSCCO samples. In the case that this insulation phase surrounds the super -conductive phase entirely, the sample might not show the global superconductivity by cutting off electrical paths in the four probes method, even when it showed diamagnetic in the magnetization analysis. On the other hand, in the case that the electrical paths will be formed among the superconductive phases, the sample will reveal the superconductivity, but the critical current will be reduced in comparison with the no-fiber BPSCCO sample.

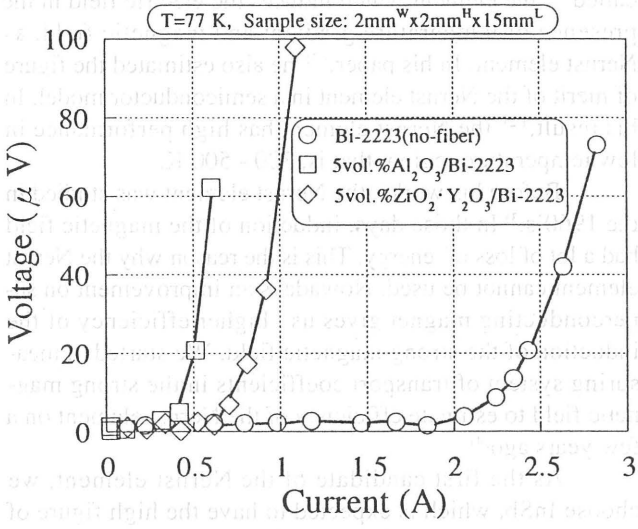

Fig. 1. Current vs. voltage properties of the fiber/BPSCCO and the no-fiber BPSCCO.

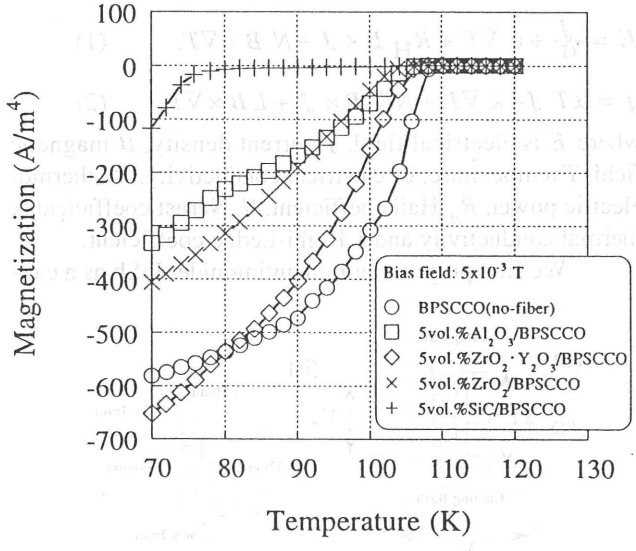

Fig. 2. Temperature vs. magnetization properties of the fiber/BPSCCO and the no-fiber BPSCCO.