§2. Basic Study on Oxide Superconductors for Nuclear Fusion Reactor

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1. Introduction

Last year we studied the temperature dependences of the ac losses in YBCO superconducting tapes fabricated by IBAD-PLD method to understand the basic electromagnetic properties. This year we investigated the temperature dependences the ac losses of YBCO superconducting tapes fabricated by TFA-MOD method in a similar way.

2. Magnetization measurement and I_c estimation

First we measured the magnetization curves of sample YBCO tapes in perpendicular magnetic field to the wide surface. The observed results are shown in Fig.1. Sample straight tapes with a length of 60mm were inserted into a saddle-shaped pickup coil. Magnetic field was applied in perpendicular to the wide surface. Temperature ranged from 31 to 77K.

Next we estimated I_c-B characteristics by using the magnetization curves and the following expression,

$$\begin{aligned} I_c(B) &= 4h \times \{((I_c(B)/2) \times (w/2))/\ wh\} \\ &= 4h \times (m(B)/wh) \\ &= 4h \times M(B) \end{aligned}$$

where $m(B)$ is the magnetic moment due to the induced shielding current at the applied field, B, w and h is the width and the height of superconducting layer. The estimated I_c-B characteristics are shown in Fig.2 in log scale.

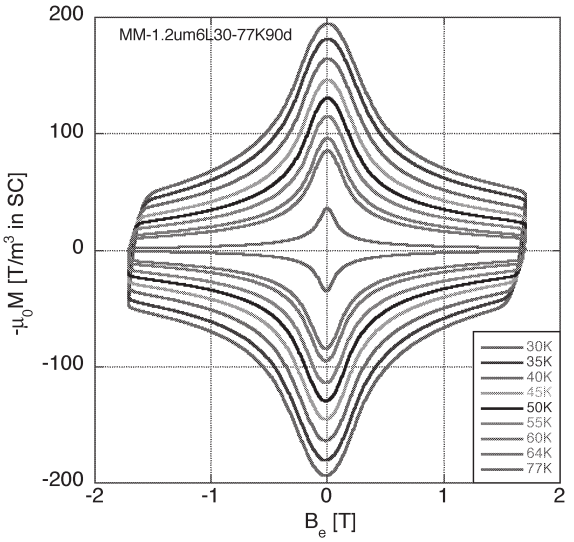

Fig.1 Observed magnetization curves

Here we found out that the specific field at the breaking point of I_c-B curves, B_b, and the constant I_c around zero field, I_{c0}, have the same temperature dependence and that the B dependences of I_c are the same for $B > B_b$ regardless of temperature. So we normalized the I_c-B curves by I_{c0}. The obtained result is shown in Fig.3. We can see that the normalized I_c-B curves coincide with each other and the I_c-B characteristics are scaled with temperature. As a result, it was shown that the magnetization and ac losses were scaled with temperature.

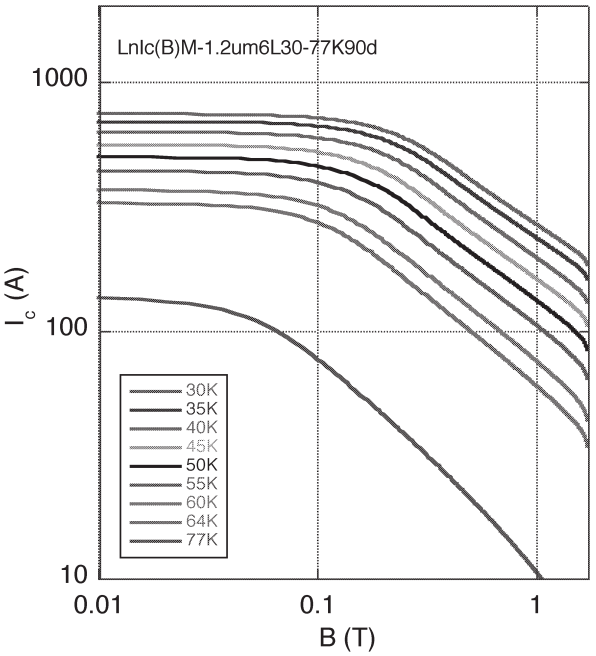

Fig.2 Estimated I_c-B curves by using the observed magnetization curves

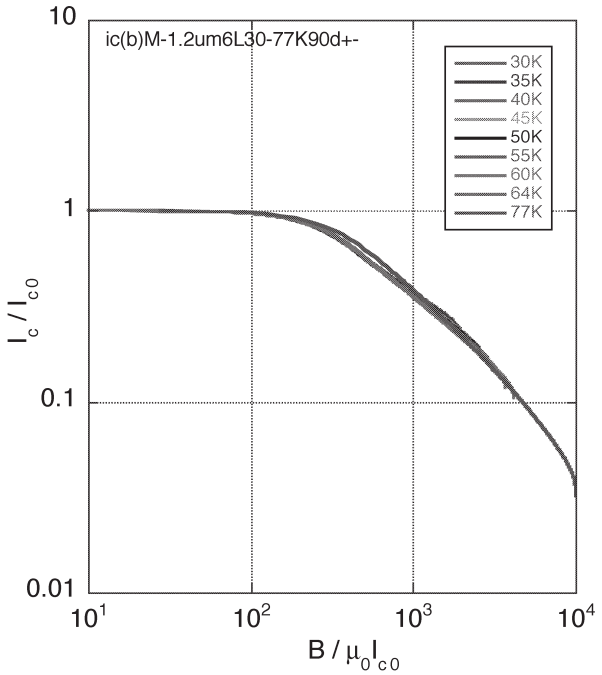

Fig.3 Normalized I_c-B curves by using zero field I_c at the respective temperatures