間欠回転磁場下で配向させた $DyBa_2Cu_3O_y$ 粉末の粒径と配向度の関係

Relationship between orientation degrees and grain size for $DyBa_2Cu_3O_y$ powder samples aligned in intermitted rotation magnetic fields

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$REBa_2Cu_3O_y$ (RE123, y~7) superconductors exhibit 90 K-class of critical temperatures and intrinsically high critical current properties. Due to layered crystal structure and weak link at a grain boundary, bi-axial crystal orientation is required in addition to the formation of densified microstructure for practical use of RE123. Epitaxial growth technique is typical for the formation of bi-axial orientation of RE123. Recently, our group reported bi-axial alignment by modulated rotating magnetic fields in epoxy resin [1,2] and high tri-axial magnetic anisotropy of RE=Dy [3] at room temperature for twin-free RE-Ba-Cu-O compounds. From the viewpoint of practical use of RE-Ba-Cu-O superconductors, bi-axial magnetic alignment for RE123 compoundsis desirable. However, RE123 contains twin microstructure in its grain. In the present study, to clarify behaviors of Dy123 powders under modulated rotating magnetic fields, we fabricated powder samples aligned under various intermitted rotation magnetic fields at room temperature using Dy123 powders with various average diameters (d).

Figures 1(a) and 1(b) show (103) pole figures for the Dy123 powder samples aligned under intermitted rotation magnetic fields of 1 T using the powders with d = 27.3 and 9.6 μm, respectively. Here, resting time at a half rotation and rotation speed in the intermitted rotation magnetic field are 2 s and 60 rpm, respectively. Obvious four-fold symmetric peaks were observed for these two pole figures, and Dy123 powders in both samples were found to be bi-axially aligned in the magnetic field condition. However, the peaks for d = 9.6 μm were sharper than those for d = 27.3 μm. Magnetic energy for grain orientation is proportional to volume of particle; therefore, the magnetic energy for d = 27.3 μm is calcurated to be roughly 25 times larger than that for d = 9.6 μm. However, the result in Fig. 1 is inconsistent of the prediction from magnitude relationship of the magnetic energy. In the present study, secondary electron images, XRD patterns and orientation degrees will be shown in addition to the (103) pole figures for the samples using various grain sizes.

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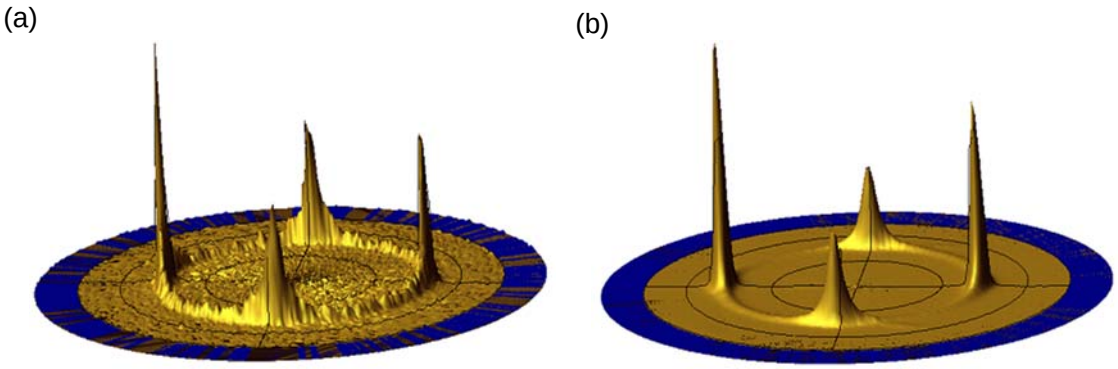

Fig. 1 (103) pole figures for the magnetically aligned Dy123 powder samples with (a) d = 27.3 and (b) d = 9.6 μm.

References:
[1] Fukushima, *et al*., *Appl. Phys. Express* **1** (2008) 111701.
[2] Yamaki *et al*., *Jpn. J. Appl. Phys.* **51** (2012) 010107.
[3] Horii *et al*., *J. Appl. Phys.* **115** (2014) 113908.