Effect of high temperature compression deformation on the evolution of microstructure and texture of sintered $Ca_3Co_4O_9$

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Abstract

Increase in electrical conductivity is a key issue for the practical application of $Ca_3Co_4O_9$. The development of (001) texture is experimentally examined as a solution for this purpose. It is found that high temperature compression deformation is effective for the development of the texture, resulting in the decrease in electrical resistivity.

Experimental

1. Specimen preparation

Powder compact with relative density of 53%
Specimen dimension: ϕ 14.0mm x 13.0mm

2. Uniaxial compression

1153K and 1193K, target true strain −1.5

3. Texture measurements

Schulz reflection method using CuKα

4. Measurements of electrical resistivity

Four-probe method, 573K-1073K, parallel to the compression plane

Results and discussion

(001) (compression plane) texture develops with the change in grain shape by the high temperature deformation. The highest area fraction of crystal grains within 10° from (001) orientation is 61% at present.

The value of figure of merit for textured $Ca_3Co_4O_9$ is given by the blue line in Fig. 1. Further development of (001) texture is promising for the practical application of this material.

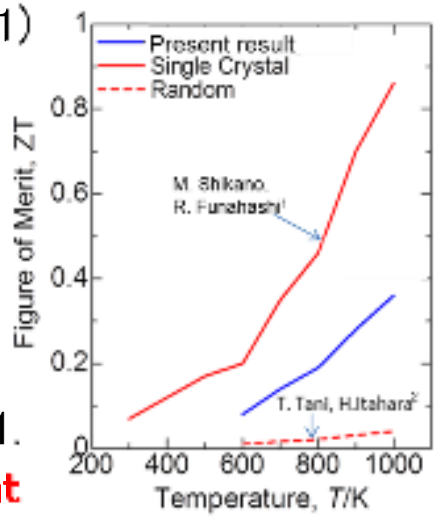

Fig. 1 ZT-T relationship. Seebeck coefficient and thermal conductivity of single crystal [1] are used for the calculation.