Thermoelectric Properties of Textured Ca$_3$Co$_4$O$_9$ Prepared by Large Grain Sized Powder

M. Mikami$^1$, K. Chong$^2$, E. Guilmeau$^1$, D. Chateigner$^3$, R. Funahashi$^1$

$^1$National Institute of Advanced Industrial Science and Technology, Ikeda, Osaka 563-8577, Japan
$^2$Osaka Electro-Communication University, Neyagawa, Osaka 572-0833, Japan
$^3$CRISMAT-ENSICAEN Laboratory, UMR CNRS 6508, 14050 Cean Cedex, France
E-mail: m-mikami@aist.go.jp

The layered-structural Ca$_3$Co$_4$O$_9$ (Co-349) exhibits promising thermoelectric properties in the viewpoint of practical use as thermoelectric power generation. For that purpose, highly grain-aligned polycrystalline bulk materials are required because of its anisotropic transport properties. Powders with different grain sizes, grown in a K$_2$CO$_3$-KCl solvent, were used to synthesize hot-forged Co-349 compounds. Neutron diffraction experiments evidenced the effect of grain size on the development of the $c$-axis grain-alignment. The electrical conductivity in the direction perpendicular to the hot-forged axis was improved for higher degrees of orientation and larger grain sizes. Since the resistivity was reduced without deterioration of the Seebeck coefficient, the power factor of the Co-349 sample was improved.