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Method to Measure the Seebeck Coefficient of Thermoelectric Thin Film for Energy Generation

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Extended Abstract

Although world energy consumption has increased, the fossil source is being restricted which occupy the majority of energy source because the fossil sources are suspected of causing global climate change. So various approaches for power generation from non-fossil sources have been extensively investigated.

Among these approaches, thermoelectric generator is well known for its many advantages. Thermoelectric generator could directly convert the heat, obtained from various sources such as vehicles, solar energy in the form of infrared light, and human body temperature, into electric power. And thermoelectric generator has simple mechanical structure, therefore it has less malfunctions and can be maintained easily. And the thermoelectric material can be applied micro scale thermoelectric generator by structuring of nano scale thermoelectric thin film (Leonov et al., 2007).

Seebeck coefficient is an important parameter for evaluation of thermoelectric generator. There are various methods for measurement of Seebeck coefficient for bulk type material (Hsu et al., 2004), nanowire type (Hochbaum et al., 2008), and thin film type of in-plane direction (Mavrokefalos et al., 2007). But these methods cannot represent measurement results of Seebeck coefficient of thermoelectric thin film of cross-plane direction, because most of thermoelectric materials have anisotropic thermoelectric properties (Yang et al., 2002).

In this study, we researched the temperature gradient and potential difference of thin film type thermoelectric material with the conduction theory and thermoelectric effects. To predict the temperature gradient, we calculated the heat flux by referring the conduction theory with the reference materials. And to analyse the potential difference, we considered the Lorentz force and Peltier and Seebeck effect. From the achieved result, we suggested new method to measure the Seebeck coefficient of thin film type thermoelectric material in the cross-plane direction.

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