Thermoelectric Properties and Crystal Structures of Au doped Composites

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Recently, silicon semiconductor devices have been progressed efficiency with gain of developed power. One of the most considerable problems interfering the development is that because of Joule heating, their devices are not capable of conduct an electric current of the spec. Yamaguchi *et.al* [1)] suggested new cooling system using of the Peltier material plate named "Self-Cooling Semiconductor Device". This technology carries out the Peltier cooling with the use of flowing current in silicon power device (e.g PowerMOSFET, IGBT) itself by using of thermoelectric material instead of cupper electrode in silicon power devices.

Thermoelectric properties of this applicable material are demanded the higher electrical conductivity, thermal conductivity and seebeck coefficient different from conventional thermoelectric material. Silicon carbide has considerable promise as the Self-Cooling Device material since it takes advantage of these desirable features.

The purpose of this study is to enhance the thermoelectric properties and to clarify crystal structures depend on temperature for Au doped SiC/Si composites in order to apply the Self-Cooling Semiconductor Device. In this work, Au doped SiC/Si composites with polysilastyrene (PSS) additive as the sintering aids have been fabricated by conventional sintering process and investigated the thermoelectric properties and crystal structure.

We have decided the composition of SiC/Si/Au system showing high-power factor. Hall coefficient measurements at room temperature reveal that the increase of electrical conductivity originates the rise of mobility. Scanning electron microscope observations confirm the grain growth by virtue of PSS additive, and the correlation between sample density and electrical conductivity is revealed. High temperature XRD measurement is revealed that the phase transition from 3C-SiC to 6H-SiC occurs along with the rise of temperature for 1173K.

[1)]S.Yamaguchi, Y.Okamoto, A.Yamamoto and M.Hamabe, *Proc. 26th Int. Conf. Thermoelectrics*, O-G-1, (2007).

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