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Effect of Sn dopant on thermoelectric properties of β-$FeSi_2$

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β-$FeSi_2$ has been classified as a potential candidate for high temperature thermoelectric (TE) application due to low cost, nontoxic, thermal stability, and strong oxidation resistance; however, its low dimensionless figure of merits (ZT) limits the material's application. The common technique to improve ZT is to dope with impurities. Ohtaki et *al.* (1993) investigated the effect of Cu, Zn, Nb, Ag, and Sb doping on the crystalline β-$FeSi_2$ and showed that the microstructures of the samples were significantly varied by those dopants leading to obtain ZT_{max}= 0.026 at 873 K. On the other hand, Lan et *al.* (2019) studied the effect of Sn doping on TE properties of the crystalline GeTe and showed that the presence of Sn enhanced the power factor (PF) of the samples. Then, the purpose of this study is to study on the effect of Sn dopant on β-$FeSi_{2-x}Sn_x$ ($0.0 \leqq x \leqq 0.10$). β-$FeSi_{2-x}Sn_x$ ingots were prepared by arc-melting under Ar atmosphere. The microstructures were observed by SEM (VE8800, KEYENCE). Powder XRD data were measured by CuK_α diffractometer (SmartLab, Rigaku). ZT was measured from the Seebeck coefficient and resistivity by using ResiTest8300 and homemade apparatus, and thermal conductivity was measured by power conversion efficiency apparatus (PEM-2, ULVAC-RIKO). As a result, Sn doping affects the grain boundary of β-$FeSi_{2-x}Sn_x$; therefore, this phenomenon scatter phonon resulting in shorter relaxation time which thus reduce thermal conductivity and improve ZT of β-$FeSi_2$.