A study of iron-doped SiGe growth for thermoelectric applications

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Silicon-germanium (SiGe) alloy has been studied for thermoelectric (TE) generators for decades due to its stability at high temperature. However, its low TE performance at low temperature remains a problem. Nanoinclusions improves the TE performance, but the material and processing costs are still high. Here, we proposed a method by embedding silicide during crystal growth; in-situ observation at different cooling rates was carried out. At a cooling rate of 100 K/min, a SiGe alloy containing α-$FeSi_2$ precipitates was grown which yielded a relatively low lattice thermal conductivity κ_{lat} of 4.80 $Wm^{-1}K^{-1}$ and a good ZT value of 0.08 at room temperature. This was comparable to the commercial SiGe alloy, but the germanium used was reduced by 25% and the process was much faster.