In-situ Ga doping of fully strained Ge$_{1-x}$Sn$_x$ heteroepitaxial layers grown on Ge(001) substrates - DTU Orbit (18/08/2019)

In-situ Ga doping of fully strained Ge$_{1-x}$Sn$_x$ heteroepitaxial layers grown on Ge(001) substrates
We have investigated the Ga and Sn content dependence of the crystallinity and electrical properties of Ga-doped Ge$_{1-x}$Sn$_x$ layers that are heteroepitaxially grown on Ge(001) substrates. The doping of Ga to levels as high as the solubility limit of Ga at the growth temperature leads to the introduction of dislocations, due to the increase in the strain of the Ge$_{1-x}$Sn$_x$ layers. We achieved the growth of a fully strained Ge$_{0.922}$Sn$_{0.078}$ layer on Ge with a Ga concentration of $5.5 \times 10^{19}$/cm$^3$ without any dislocations and stacking faults. The resistivity of the Ga-doped Ge$_{1-x}$Sn$_x$ layer decreased as the Sn content was increased. This decrease was due to an increase in the carrier concentration, with an increase in the activation level of Ga atoms in the Ge$_{1-x}$Sn$_x$ epitaxial layers being induced by the introduction of Sn. As a result, we found that the resistivity for the Ge$_{0.950}$Sn$_{0.050}$ layer annealed at 600°C for 1min is 3.6 times less than that of the Ga-doped Ge/Ge sample.

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