Enhanced Dopant Activation in Strained-Si/Si\textsubscript{1-x}Ge\textsubscript{x} Substrate using Non-melt Laser Annealing

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Introduction

Strained-Si/SiGe substrate comprises a thermally insulating layer, which deprives a good thermal dissipation pathway. This gives rise to a highly non-equilibrium laser process and can vary significantly to that in normal bulk silicon substrate. In this work, we compare the formation of ultra-shallow \textit{p}/n junctions in bulk silicon and strained-Si/SiGe substrates using laser annealing (LA) in shallow-melt and non-melt regimes.

Experiment

Boron distribution in (a) strained-Si/SiGe substrate is always deeper and more abrupt than that in the (b) bulk silicon substrate.

In non-melt regime, laser annealing produces dopant profiles of negligible diffusion (above) and improved activation in the strained-Si/SiGe substrates with laser pulses (below).

No degradation in the strain in the strained-Si layer was induced after non-melt laser annealing.

Conclusion

\begin{itemize}
  \item Thermal insulation of SiGe layer enhances heating and melting of strained-Si/SiGe substrate during LA.
  \item Non-melt LA formed diffusionless highly activated \textit{p}/n junctions in strained-Si without degradation in strain.
\end{itemize}

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