

Large-Area Single-Crystalline Silicon/Germanium Film Using Laser Crystallization for Monolithic 3DICs Platform

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Abstract

This study introduces a large-area single-crystal epi Si/Ge film for monolithic three-dimensional integrated circuits (3DICs) using the laser crystallization technique. This technique employs a green nanosecond pulse laser to produce large-area single-crystal Si /Ge films with uniform (100) orientation on SiO₂. Thermal simulations using COMSOL Multiphysics confirm that the thermal budget of the underlying Si substrate remains below 400°C during the laser crystallization process, ensuring compatibility with 3D integration. Furthermore, this study demonstrates 3D inverters fabricated using the large-area single-crystal Si films, featuring an inter-layer metal M0 positioned between two layers of Si FinFETs. This highlights the potential for improved performance, power efficiency, and area reduction in 3DICs. Overall, the integrated approach showcases the capability of this technique to advance semiconductor fabrication for next-generation 3DICs.

Keywords - *monolithic 3DICs, laser crystallization, green nanosecond pulse laser*