



High Mobility and Quantum Well Transistors: Design and TCAD Simulation (Springer Series in Advanced Microelectronics)

Geert Hellings, Kristin De Meyer

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For many decades, the semiconductor industry has miniaturized transistors, delivering increased computing power to consumers at decreased cost. However, mere transistor downsizing does no longer provide the same improvements. One interesting option to further improve transistor characteristics is to use high mobility materials such as germanium and III-V materials. However, transistors have to be redesigned in order to fully benefit from these alternative materials.

High Mobility and Quantum Well Transistors: Design and TCAD Simulation investigates planar bulk Germanium pFET technology in chapters 2-4, focusing on both the fabrication of such a technology and on the process and electrical TCAD simulation. Furthermore, this book shows that Quantum Well based transistors can leverage the benefits of these alternative materials, since they confine the charge carriers to the high-mobility material using a heterostructure. The design and fabrication of one particular transistor structure - the SiGe Implant-Free Quantum Well pFET – is discussed. Electrical testing shows remarkable short-channel performance and prototypes are found to be competitive with a state-of-the-art planar strained-silicon technology. High mobility channels, providing high drive current, and heterostructure confinement, providing good short-channel control, make a promising combination for future technology nodes.

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