Interface strain study of ultra-thin HfO_2 films on Ge and GeSn substrates using HR-RBS

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Strain depth profiling has been performed and studied in ultra-thin HfO_2 (3.8nm) films deposited on Ge (001) and $Ge_{0.92}Sn_{0.08}$ (001) substrates using high-resolution Rutherford backscattering spectroscopy in combination with angular channeling scans. Furthermore, interface quality and substrate crystal quality were determined for these samples. Both Ge and GeSn have been studied extensively in recent years as they are candidates for the replacement of Si in high-speed and low-power microelectronic devices. GeSn compounds are promising because of their large carrier mobility and the possibility for direct bandgap semiconductor formation. HfO_2 is utilized as a high-k dielectric in Si technology, and investigated as an alternative dielectric for GeSn substrates. Therefore, quantitative analysis of the interface quality and the lattice strain in HfO_2/Ge and HfO_2/GeSn may be of critical importance, because these properties will determine electrical properties in devices.