Novel anhydrous hydrazine delivery for low temperature silicon nitride passivation of SiGe(110)

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New high mobility channel materials such as SiGe, Ge, and InGaAs create difficult thermal constraints on Metal-Nitride deposition, where limits range from 300-400°C. It is necessary to limit atomic diffusion; prevent undesirable phase transitions, strain relaxation and defect formation. Feasibility for low temperature hydrazine (H2NNH2) ALD was reported by George.³ In addition, a new technology that is capable of generating and delivering stable and highly concentrated anhydrous hydrazine gas has been developed by RASIRC.

A thin layer of silicon nitride can act as a diffusion barrier or channel passivation layer prior to dielectric deposition in FinFet or MOSFETs. When employed as a channel passivation layer, further oxidation with anhydrous peroxide leaves Si-N-OH termination, thereby providing good nucleation for High K deposition (Figure 1). This study focuses on developing <400°C silicon nitride ALD process. STM/STS and XPS are employed to characterize SiNₓ film growth on Si₀.₅Ge₀.₅(110) (Figure 2). HfO₂ is then grown on a Si-N-OH functionalized surface. Electrical characterization of MOSCAP structures will be compared to other passivation methods.

Figure 1. SiGe passivation and surface preparation for High K growth

Figure 2. 20 cycle low temperature Silicon Nitride growth