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**Thermal Stability and Laser Annealing of $Si_{1-y}C_y$ alloys** STEFAN ZOLLNER, P. GRUDOWSKI, V. DHANDAPANI, G. SPENCER, A. THEAN, Freescale Semiconductor, Inc. — Dilute alloys of silicon and carbon are metastable, but can be produced (up to 3% C) using nonequilibrium growth techniques, such as chemical vapor deposition. In such alloys, carbon atoms are located at lattice sites (preferred for device applications) or at interstitial sites. Other impurities (such as H) can be introduced during the growth process. Since Si:C alloys are metastable, they usually do not survive typical source-drain dopant activation anneals (on the order of 1000C for 5s). Also, Si:C alloys implanted with NMOS dopants do not recrystallize during conventional source-drain dopant activation anneals. We report here that the vertical lattice constant of as-grown Si:C alloys (measured by XRD) decreases after laser annealing ($\sim$1 ms near the melting point), leading to an increase in the measured substitutional carbon content. This indicates a conversion of interstitial carbon defects into substitutional carbon or an evolution of hydrogen. We describe our results using a multiscale model applicable to thermal processing over a broad range of temperature and anneal times. Our model describes both solid-state regrowth and the loss or gain of substitutional carbon after annealing. We also present NMOS transistor results, where embedded Si:C alloy source-drain stressors lead to a reduction in the channel resistance.

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