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Silicon epitaxy onto silicon wafers above 600 $^\circ$C by 100 nm/min hot-wire chemical vapor deposition[1] PAUL STRADINS, CHARLES W. TEPLIN, KIM JONES, ROBERT C. REEDY, QI WANG, HOWARD M. BRANZ, National Renewable Energy Laboratory — We study a new silicon epitaxy regime by hot-wire chemical deposition onto silicon surfaces above 600 $^\circ$C. In this regime, epitaxy proceeds at high growth rates (>100 nm/min) compared with lower-T growth, and does not appear to be thickness-limited. With a tantalum hot-wire operating at 1900 $^\circ$C in SiH_4, we obtain phase-pure Si at 77 nm/min on (100)-oriented wafers at 650 $^\circ$C. With a tungsten filament at 2100 $^\circ$C, phase-pure epitaxy proceeds faster than 100 nm/min from 620 to 700 $^\circ$C. Epitaxial growth up to 11μm thick is confirmed by transmission electron microscopy, x-ray diffraction and in-situ ellipsometry. This relatively low T epitaxial growth regime could be utilized for photovoltaic devices made by epitaxial thickening of c-Si seeds on low-cost substrate such as borosilicate glass. Temperature above 600^{o}C and corresponding thermal dehydrogenation of the growing surface is critical for the high-quality, rapid epitaxial growth: between 450 and 600 $^\circ$C, there appears to be an intermediate region where epitaxy is poor or nonexistent – even in comparison with epitaxy at 200 to 400 $^\circ$C. The role of gas depletion chemistry, as well as structural/electronic quality is discussed.

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