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Study of Deposition Temperature on High Crystallinity Nanocrystalline Silicon Thin Films with *In-Situ* Hydrogen Plasma-Passivated Grains

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This paper studies the effect of deposition temperature on the growth of nanocrystalline silicon (nc-Si) films deposited by 13.56MHz plasma enhanced chemical vapor deposition (PECVD) with *in-situ* hydrogen (H) passivation. A high crystalline volume fraction (X_C) of 80% was found in the ~100nm nc-Si film deposited at 260°C with 99% H_2 diluted SiH_4 at intermediate RF power between the power-limited and precursor-limited regimes. Based on these optimized deposition conditions, 300−400nm nc-Si films deposited at 75−260°C also showed a high X_C of 82−85%, an intrinsic-like dark-conductivity (σ_{dark}) of ~10^{-6}S/cm, and even a low mean oxygen content (C_O) of $10^{17}-10^{18}$at./cm^3. Although material properties were similar, deposition temperature appeared to change the qualitative structure of the nanocrystalline grains. The preferred grain orientation changed from <111> to <220> as the

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