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Nanocrystalline Silicon Films by HWCVD Method¹ PURABI GOGOI, HIMANSHU S. JHA, PRATIMA AGARWAL, Department of Physics, IIT Guwahati, Guwahati 781039, India — High quality nano-crystallites embedded amorphous silicon films are deposited using HWCVD technique by varying the substrate temperature T_S (100-350 °C) and chamber pressure P (0.08-8mbar). The precursor gas used is semiconductor grade hydrogen diluted silane (10 % silane in hydrogen) from Matheson Inc. Filament temperature (T_F) is kept constant at 1800 °C. The films are characterized by different tools viz. XRD, SEM, TEM, UV-Vis NIR spectroscopy, FTIR and PL. Both XRD and HRTEM studies indicate the presence of Nanocrystallite (size 5-10nm) in these films. The deposition rate ranges from 5-13 Å/Sec, whereas the hydrogen content varies between 2.5-5 atomic percent. The band gap of films is in the range 2.0-2.37eV. Formation of Nanocrystallites is also supported by the PL and Raman scattering studies. Deposition rate decreases with increase in T_S , whereas the crystallinity increases with T_S . The films deposited at high pressure have high deposition rate, low hydrogen content and high band gap. The films are found to be of superior electronic properties suitable for photovoltaic device applications. The tunable band gap, high deposition rate and low hydrogen content is ideal for cost effective device fabrication.

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