Developmentof phosphorus doped highly conducting n-type nano crystalline silicon film forhigh efficiency thin film solar cells

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Highlyconducting phosphorous-doped (n-type) microcrystalline silicon (μc-Si:H) or n-μc-Si:Hthin films were prepared by radio frequency plasma-enhanced chemical-vapordeposition (RF-PECVD). The effects of hydrogen dilution, doping concentration,plasma power, deposition pressure and substrate temperature on the growth andthe properties of n-type μc-Si:H thin films were investigated. The measured electricaland structural properties of these films were found to depend on the depositionconditions. For various plasma parameters, the crystalline volume fraction (X_c),dark conductivity (σ_d) and activation energy (E_a) were inthe range of 38% to 62 % 8.55+10^{-1} S/cm to 30.1 S/cm and 0.065 eV to0.024 eV, respectively. Few of these samples were used to fabricate p-i-n typesolar cells. Low power density (42.6 mW/cm^2) and substratetemperature (150 °C) showed the best properties of n-type μc-Si:H singlelayer and photovoltaic conversion efficiency of solar cell.. The photovoltaicparameters of one of the cells are as follows, open circuit voltage (V_{oc})= 900 mV, short circuit current density (J_{sc}) of 15.5 mA/cm^2,fill-factor (FF) of 70.4 % and photovoltaic conversion efficiency (η) of 9.82%

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