EFFECTS OF ARGON DILUTION OF SILANE ON THE OPTICAL PROPERTIES AND SURFACE MORPHOLOGY OF HYDROGENATED AMORPHOUS SILICON

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Abstract

Hydrogenated amorphous silicon (a.Si:H) was prepared using the d.c plasma grow discharge system. Two sets of samples were prepared and studied. The first set of samples referred to as the high argon dilution films were prepared from the discharge of pure silane at flow-rate of 5sccm and silane at the same flow-rate diluted in argon at flow-rates of 5, 10 and 15sccm. Similarly, the second set of sample referred to as the low argon dilution films were prepared from the discharge of pure silane at flow-rate of 20sccm and silane at the same flow-rate diluted in argon at the flow-rates mentioned earlier. The ionization current and the d.c voltage were maintained at 12mA and 600V respectively throughout the deposition. The a-Si:H films were prepared at room temperature for one hour. The effects of argon dilution of silane on the optical and morphological properties of the films produced were studied and analyzed. The optical transmission spectrum of the films studied were scanned using the UV-VIS-NIR spectrophotometer. The film thickness, refractive index, optical energy gap and Urbach Tail bandwidth were determined from the spectra. The surface morphology of the films were studied using the Atomic Force Microscope (AFM). High argon dilution of silane showed significant effects on the optical properties and the morphology of the films. Distinct wavy columnar clusters are observed in the films prepared from both silane flow-rates of 5 and 20sccm diluted in argon at flow-rate of 5sccm. High argon dilution of silane improved the surface morphology of the films. The refractive index and Urbach Tail bandwidth of the films decreased at the high argon dilution of silane indicating low bulk density and less disordered structure. Crystal silicon provided better growth surface for the deposition of a-Si:H films compared to glass substrates. The effects of substrates on the surface morphology of the films were diminished at high argon dilution.

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