Effect of Silicon Films Thickness on Aluminium Induced Crystallization of Hydrogene Amorphous Silicon (a-Si:H)


Abstract: Hydrogenated amorphous silicon (a-Si: H) films were deposited by DC magnetron sputtering technique with argon and hydrogen plasma mixture on Al deposited by thermal evaporation on glass substrates. The a-Si:H/Al/glass structure with different amorphous silicon thickness ranging from 200 to 1000nm were annealed at 550°C during 4 hours in vacuum-sealed bulb. The effects of amorphous silicon thickness on optical, structural and morphological properties of the vacuum-annealed a-Si:H/Al/glass are presented in this contribution. The Raman results clearly evidenced that a-Si:H film which has the same thickness as that aluminum layer presents a better crystallisation with a peak position at about 520 cm⁻¹, which is very similar to the Raman pattern of crystalline silicon (c-Si). The presence of a high intensity peak at 520 cm⁻¹ suggests that the Si crystallites are formed during Al assisted crystallization. XRD measurements clearly evidence that poly-Si is successfully induced by aluminum induced crystallization of hydrogenated amorphous silicon thin films. By increasing the thickness of a-Si:H films the intensity of the peak related to Si(111) plane increases, probably due to a preferential growth of the grains in <111> direction. XRD measurements carried out on uncoated aluminum parts, reveal the presence of the peaks characteristic of crystalline silicon for the thickness of 300nm. This result clearly shows lateral crystallization with an estimated crystalline fraction of 46%. This lateral crystallization remains weak for the thick layers and was favored when the thickness ratio between Al and a-Si:H is equal to 1.

Keywords: Hydrogenated amorphous silicon, Raman, AIC, Crystallisation, Thin films