

Synthesis of nano-crystalline Si films on polymer and glass by ICP-assisted RF magnetron sputtering

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Nano-crystalline Si thin films were deposited on polymer and glass by inductively coupled plasma (ICP) - assisted RF magnetron sputtering at low temperature in an argon and hydrogen atmosphere. Internal ICP coil was installed to increase hydrogen atoms dissociated by the induced magnetic field near the inlet of the working gases. The microstructure of deposited films was investigated with XRD, Raman spectroscopy and TEM. The crystalline volume fraction of the deposited films on polymer was about 70% at magnetron RF power of 600W and ICP RF power of 500W. Crystalline volume fraction was decreased slightly with increasing magnetron RF power due to thermal damage by ion bombardment. The diffraction peak consists of two peaks at 28.18° and 47.10° 2θ at magnetron RF power of 600W and ICP RF power of 500W, which correspond to the (111), (220) planes of crystalline Si, respectively. As magnetron power increase, (220) peak disappeared and a dominant diffraction plane was (111). In case of deposited films on glass, the diffraction peak consists of three peaks, which correspond to the (111), (220) and (311). As the substrate temperature increase, dominant diffraction plane was (220) and the thickness of incubation (amorphous) layer was decreased.