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Characteristics of Poly-Si Thin Films Prepared by IBE with a Substrate Bias System

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The preparation of polycrystalline silicon (poly-Si) thin films has received much attention due to their wide application for semiconductors such as in thin film transistors(TFTs), solar cells, peripheral circuits of liquid-crystal displays, and electrodes in Si integrated circuits. Conventionally, poly-Si films were prepared by a plasma enhanced chemical vapor deposition (PECVD) method with post annealing (~800 °C) of a-Si:H films or substrate heating (200 - 400 °C). This technique requires high processing temperatures and a long processing time. Since such a high temperature limits substrate materials or fabrication process, the deposition of poly-Si films at low temperatures has been desired, which will lead to the improvement of the throughput and the feasibility.

In our experiments, Using intense pulsed ion beam evaporation technique, we have succeeded in the preparation of poly-Si thin films without impurities on silicon substrate. Good crystallinity and high deposition rate have been achieved without heating the substrate. The crystallinity of poly-Si film has been improved with increasing the density of the ablation plasma. The intense diffraction peaks of poly-Si thin films can be obtained by using the substrate bias system. The properties of deposited films in terms of crystallinity, deposition rate and surface morphology are characterized by X-ray diffraction(XRD), Raman spectroscopy and scanning electron microscopy(SEM).

[References]

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