

스퍼터링 증착 CdTe 박막의 두께 불균일 현상 개선을 위한 화학적기계적연마
공정 적용 및 광특성 향상

Application of CMP Process to Improving Thickness-Uniformity of Sputtering-deposited

CdTe Thin Film for Improvement of Optical Properties

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Abstract : CdTe as an absorber material is widely used in thin film solar cells with the heterostructure due to its almost ideal band gap energy of 1.45 eV, high photovoltaic conversion efficiency, low cost and stable performance. The deposition methods and preparation conditions for the fabrication of CdTe are very important for the achievement of high solar cell conversion efficiency. There are some rearranged reports about the deposition methods available for the preparation of CdTe thin films such as close spaced sublimation (CSS), physical vapor deposition (PVD), vacuum evaporation, vapor transport deposition (VTD), closed space vapor transport, electrodeposition, screen printing, spray pyrolysis, metalorganic chemical vapor deposition (MOCVD), and RF sputtering. The RF sputtering method for the preparation of CdTe thin films has important advantages in that the thin films can be prepared at low growth temperatures with large-area deposition suitable for mass-production. The authors reported that the optical and electrical properties of CdTe thin film were closely connected by the thickness-uniformity of the film in the previous study [1], which means that the better optical absorbance and the higher carrier concentration could be obtained in the better condition of thickness-uniformity for CdTe thin film. The thickness-uniformity could be controlled and improved by the some process parameters such as vacuum level and RF power in the sputtering process of CdTe thin films. However, there is a limitation to improve the thickness-uniformity only in the preparation process [1]. So it is necessary to introduce the external or additional method for improving the thickness-uniformity of CdTe thin film because the cell size of thin film solar cell will be enlarged. Therefore, the authors firstly applied the chemical mechanical polishing (CMP) process to improving the thickness-uniformity of CdTe thin films with a G&P POLI-450 CMP polisher [2]. CMP process is the most important process in semiconductor manufacturing processes in order to planarize the surface of the wafer even over 300 mm and to form the copper interconnects with damascene process. Some important CMP characteristics for CdTe were obtained including removal rate (RR), WIWNU%, RMS roughness, and peak-to-valley roughness [2]. With these important results, the CMP process for CdTe thin films was performed to improve the thickness-uniformity of the sputtering-deposited CdTe thin film which had the worst two thickness-uniformities of them. Some optical properties including optical transmittance and absorbance of the CdTe thin films were measured by using a UV-Visible spectrophotometer (Varian Techtron, Cary500scan) in the range of 400 - 800 nm. After CMP process, the thickness-uniformities became better than that of the best condition in the previous sputtering process of CdTe thin films. Consequently, the optical properties were directly affected by the thickness-uniformity of CdTe thin film. The absorbance of CdTe thin films was improved although the thickness of CdTe thin film was not changed.

Key Words : CdTe, thin film solar cell, sputtering, thickness-uniformity, chemical mechanical polishing (CMP), absorbance

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