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직접 금속 음이온 빔 장치를 이용한 다결정 Si 박막 증착
Deposition of polycrystalline Si thin film on glass substrates by using a direct negative Si ion beam source

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1. 서론

Since Lecomtellec investigated the possibility of integrating polycrystalline Si(poly-si) thin film transistors onto glass substrates in 1981, growth of poly Si thin films at low temperature has been investigated for application in large area, low cost, and high performance solar cells and TFT-LCD's [1,2]. It is well known that the use of poly Si thin film in TFT-LCD's leads to a brighter screen, lower power consumption, and faster response time than amorphous Si, which has limitations such as photo degradation and low carrier mobility [3,4,5]. However, in order to growth poly Si thin film onto glass substrate, the process temperature must be below the strain point of the glass (600°C). Thus much research works have been focused on to the low temperature deposition technique which ensure polycrystalline Si growth on the glass substrate without substrate's deformation.

2. 본론

Poly-Si thin films on glass substrates were prepared using direct metal ion beam deposition (DMIBD) method. During deposition, the Si^- ions collide to growing thin film with a similar pre-selected kinetic energy. The 18% of sputter particles were changed with surface ionization and the ion/atom arrival ratio that defines the fraction of energetic Si ion from the depositing particles was about 0.4. The deposition rates decreased with increasing ion beam energy from 5 to 2 nm/min.

From AFM images, it is supposed that high ion beam energy produced rougher surface than that of low ion beam energy due to re-sputtering. The TEM scanning and X-ray diffraction spectra shown that polycrystalline Si films could be grown at a substrate temperature of 500℃, which is below the glass deformation temperature and also illustrate the grain size can be controlled by adjusting the Si ion beam energy.

3. 결과

In this paper, we report the formation of poly-Si thin films at low substrate temperature, 500℃, with the DMIBD technique by compensating for the thermal energy loss due to the low substrate temperature with the Si- ion beam energy. The X-ray diffraction spectra show that the beginning of crystallization appeared at 500°C. However, AFM measurements indicate that too high an ion beam energy leads to a rough surface due to the resputtering effect. Thus, since there is optimum ion beam energy for morphology and surface roughness, the Si^- ion beam energy should be controlled to obtain the optimized surface morphology.

참고문헌

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