F-5

열처리에 따른 a-IGZO 소자의 전기적 특성과 조성 분포

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Hydrogenated amorphous Si (a-Si:H), low temperature poly Si (LTPS) 등 기존 thin film transistors (TFTs)에 사용되던 채널 물질을 대체할 재료로써 다양한 연구가 진행되고 있는 amorphous indium-gallium-zinc-oxide (a-IGZO)는 TFT에 적용하였을 때 뛰어난 전기적 특성과 재연성을 나타낼 뿐만 아니라 넓은 밴드갭을 가져 투명소자로도 응용이 가능하다. 본 연구에서는 a-IGZO의 열처리에 따른 소자의 전기적 특성과 조성 분포의 관계를 확인하기 위해 다음과 같이 실험을 진행하였다. Si/SiO2 기판 위에 DC sputter를 이용하여 IGZO를 증착하고 350°C에서 열처리를 한 후 evaporator로 Al 전극을 형성시켰다. 이 때 전기적 특성의 변화를 비교하기 위해 열처리 한 샘플과 열처리 하지 않은 샘플에 대해 I-V 특성을 측정하였고, 채널 내부의 조성 분포 변화를 transmission electron microscopy (TEM)의 energy dispersive spectrometer (EDS)를 이용하여 관찰하였다. 그 결과 열처리 된 a-IGZO 채널 층의 산소 비율이 감소하였으며 전체적인 조성이 고르게 분포 되었고 전기적 특성은 향상되었다.

Keywords: Indium gallium zinc oxide (IGZO), TFT, Elemental distribution

F-6

Improved Conductivities of SWCNT Transparent Conducting Films on PET by Spontaneous Reduction

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Single-walled carbon nanotubes (SWCNT) are transparent in the visible and show conductivity comparable to copper, and are environmentally stable. SWCNT films have high flexibility, conductivity and transparency approaching that indium tin oxide (ITO), and can be prepared inexpensively without vacuum equipment. Transparent conducting Films (TCF) of SWCNTs has the potential to replace conventional transparent conducting oxides (TCO, e.g. ITO) in a wide variety of optoelectronic devices, energy conversion and photovoltaic industry. However, the sheet resistance of SWCNT films is still higher than ITO films. A decreased in the resistivity of SWCNT-TCFs would be beneficial for such an application. We fabricated SWCNT sheet with $KAuBr_4$ on PET substrate. Arc-discharge SWCNTs were dispersed in deionized water by adding sodum dodecyl sulfate (SDS) as surfactant and sonicated, followed by the centrifugation. The dispersed SWCNT was spray-coated on PET substrate and dried on a hotplate at 100°C. When the spray process was terminated, the TCF was immersed into deionized water to remove the surfactant and then it was dried on hotplate. The TCF film was then treated with AuBr4-, rinsed with deionized water and dried. The surface morphology of TCF was characterized by field emission scanning electron microscopy. The sheet resistance and optical transmission properties of the TCF were measured with a four-point probe method and a UV-visible spectrometry, respectively. HNO_3 treated SWCNT films with Au nano-particles have the lowest 61 Ω/< sheet resistance in the 80% transmittance. Sheet resistance was decreased due to the increase of the hole concentration at the washed SWCNT surface by p-type doping of $AuBr_4^-$.

Keywords: Transparent conducting films (TCF), Single-well carbon nanotubes (SWCNT), Spray coating