TW-P006

Improved Electrical and Optical Properties of ITO Films by Using Electron Beam Irradiated Sputter

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Thin transparent conductive oxides (TCOs) having a thickness lower than 30 nm have been widely usedin touch screen panels. However the resistivity of the TCO films significantly increases as the thickness decreases, due to the poor crystallinity at very thin thickness of TCO films. In this study, we have investigated the effect of electron beam irradiation during the sputtering on the electrical properties and transmittance of 30 nm-thick ITO films, which have a different SnO2 atomic percent, prepared by magnetron sputtering at room temperature. Fig. 1 shows the variation of resistivity of ITO films with a different SnO2 atomic percent for both the normal ITO films and electron beam irradiated ITO films. As shows in Fig. 1, the electron beam irradiation to the ITO (SnO2 weight percent 10%) films during the sputtering resulted in a significantly decreased in resistivity from 7.4×10^{-4} Ω-cm to 1.5×10^{-4} Ω-cm and it also increased in transmittance from 84% to 88% at a wavelength of 550 nm. These results can be attributed to energy transfer from electron to ad-atoms of ITO films during the electron beam irradiated sputtering, which can enhance the crystallinity of 30 nm-thick ITO films. It is strongly indicate that electron beam irradiation can greatly improve the electrical properties and transmittance of very thin ITO films for touch screen panels, flexible displays and solar cells.

Keywords: ITO, Electron beam, TCO

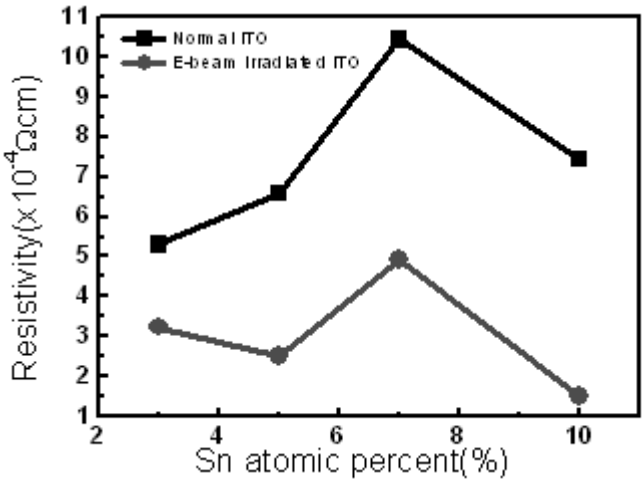
Normal ITO
E-beam Irradiated ITO
Resistivity(x10-4Ωcm)
Sn atomic percent(%)
11
10
9
8
7
6
5
4
3
2
1
2
4
6
8
10

Fig. 1.