수소 첨가에 의한 비정질 ITO 박막의 기계적 특성 연구

Effect of Hydrogen on Mechanical Stability of Amorphous In–Sn–O thin films for flexible electronics

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초 록: Transparent conductive oxides (TCOs) have attracted attention due to their high electrical conductivity and optical transparency in the visible region. Consequently, TCOs have been widely used as electrode materials in various electronic devices such as flat panel displays and solar cells. Previous studies on TCOs focused on their electrical and optical performances; there have been numerous attempts to improve these properties, such as chemical doping and crystallinity enhancement. Recently, due to rapidly increasing demand for flexible electronics, the academic interest in the mechanical stability of materials has come to the fore as a major issue. In particular, long-term stability under bending is a crucial requirement for flexible electrodes; however, research on this feature is still in the nascent stage.

Hydrogen-incorporated amorphous In–Sn–O (a-ITO) thin films were fabricated by introducing hydrogen gas during deposition. The hydrogen concentration in the film was determined by secondary ion mass spectrometry and was found to vary from 4.7×10^{20} to 8.1×10^{20} cm^{-3} with increasing H_2 flow rate. The mechanical stability of the a-ITO thin films dramatically improved because of hydrogen incorporation, without any observable degradation in their electrical or optical properties. With increasing hydrogen concentration, the compressive residual stress gradually decreased and the subgap absorption at around 3.1 eV was suppressed. Considering that the residual stress and subgap absorption mainly originated from defects, hydrogen may be a promising candidate for defect passivation in flexible electronics.