THE EFFECT OF O3 ASSISTANCE TO CORUNDUM STRUCTURED In2O3:Sn AND ITS STABILITY TO GAMMA-RAY EXPOSURE

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Corundum-structured rhombohedral indium tin oxide (rh-ITO), an oxide semiconductor, is a metastable phase of ITO and has been utilized as epitaxial bottom electrodes in oxide semiconductor devices with corundum structure.[1] Despite its potential, there is limited understanding of rh-ITO properties due to its thermodynamic metastability. This study investigated the impact of O3 assistance in the carrier gas during mist CVD growth and gamma-ray irradiation on the properties of the rh-ITO. O3 assistance during the mist CVD growth of corundum-structured In2O3 has been reported to improve surface morphology, and similar effects can be anticipated for the rh-ITO.[2] The examination of gamma-ray exposure provides valuable insights into device operation in harsh environments such as high radiation areas.

Mist CVD was employed for the thin film growth of rh-ITO. X-ray diffraction 2θ-ω measurements revealed that single-phase rh-ITO was successfully grown on c-plane sapphire with α-Ga2O3 buffer layers regardless of O3 assistance. Scanning electron microscopy images (Figure 1) clearly depict the improved surface morphology of rh-ITO with O3 assistance. Co-60 was utilized as the source of gamma-ray irradiation, with a dose of 77 kGy. No significant effect of gamma-ray irradiation was observed on the structural and electrical properties of the rh-ITO thin films, indicating high stability under irradiation.

This study revealed the enhancement of crystal quality of rh-ITO through O3 assistance and its robust stability to the radiative environment exposed to gamma-ray irradiation. In the presentation, detailed effects of O3 assistance and gamma-ray irradiation will be discussed.