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論　文　内　容　要　旨

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学位論文題目	Fabrication of Transparent Conductive Oxide Thin Films in the In-Ga-Zn-O and In-Sn-Zn-O Systems by Facing-Target DC-sputtering Technique (対向ターゲット式DCスパッタリング法によるIn-Ga-Zn-Oおよび In-Sn-Zn-O系透明導電性酸化物薄膜の作製)		

Summary

The thesis is divided into the following sections:

Chapters 1 and 2 elucidate that fundamentals, synthesis and characterization of transparent conductive oxides and objectives of this work. The transparent conductive oxides have been developed rapidly in recent years, especially in flat-panel LCDs, thin film transistors (TFTs), solar cell transparent electrodes, and a wide range of other application, due to their excellent photoelectric properties. Thin films in the systems of In-Ga-Zn-O (IGZO) and In-Sn-Zn-O (ITZO) have been reported in recent ten years. However, the film preparations require highly skilled technique and easy and reproducible film preparations have been demanded. In this work, a facing-target DC-sputtering technique was applied for preparations of these films, which enabled us to fabricate IGZO and ITZO films easily with good reproducibility. This section also introduces some principles and testing methods, performance evaluation procedures for the transparent conductive oxides.

Chapter 3 shows experimental research on IGZO Material. Amorphous IGZO thin films were deposited on glass substrates by DC co-sputtering. Deposition was carried out at different condition at an argon gas. X-ray diffraction analyses were conducted with monochromatized Cu Kα radiation to gain structural information each film. The electrical properties, resistivity, Hall mobility and carrier concentration of the films were determined using the Van der Pauw method via Hall effect measurements. The transmittance of the film was measured by a UV-Vis spectrometer. The film thickness was estimated from the optical interference observed between the film and substrate.

Chapter 4 describes Experimental Research on ITZO Material. ITZO thin films were deposited on glass substrates by DC co-sputtering. Deposition was carried out at different condition. X-ray diffraction analyses were conducted with monochromatized Cu Kα radiation to gain structural information about each film. The electrical properties, resistivity, Hall mobility and carrier concentration of the films were determined using the Van der Pauw method via Hall effect measurements. The transmittance of the film was measured by a UV-Vis spectrometer. The film thickness was also estimated.

The dissertation is concluded in Chapter 5. In the present study, excellent electrical properties in the semiconductor layer of TFTs were obtained for IGZO thin films. Hall mobility of the composition optimized thin film reached to 12 $cm^2V^{-1}s^{-1}$, with a resistivity of 0.15 Ωcm. The Hall mobility was attained ten times larger than that of amorphous silicon (a-Si, reference); the same as that of a commercial IGZO thin film. The obtained composition was In: Ga: Zn=1:1:1, which is the ideal IGZO composition, $InGaZnO_4$. Amorphous ITZO films were also obtained with electrical parameters, high resistivity of 0.17 Ωcm and high mobility of 10 $cm^2V^{-1}s^{-1}$. Compared with the IGZO thin films in this work, the resistivity and mobility of ITZO were compatible and promising for applications in next-generation TFT devices, even though the optimization of film composition has not yet been completed.