유도 결합 플라즈마에 의해 식각된 ITO 특성 연구

A Study of Etched ITO Characteristics by Inductively Coupled Plasma

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Abstract : The etching characteristics with etch rate of ITO thin films in an $O_2/BCl_3/Ar$ plasma were investigated. The etch rate of ITO thin films increased with increasing O_2 content from 0 to 10 % in BCl_3/Ar plasma, whereas that of ITO decreased with increasing O_2 content from 10 % to 30 % in BCl_3/Ar plasma. The maximum etch rate of 65.9 nm/min for the ITO thin films was obtained at 10 % O_2 addition. The etch conditions were the RF power of 500 W, bias power of 200 W, and process pressure of 2 Pa. The analysis of x-ray photoelectron spectroscopy (XPS) was carried out to investigate the chemical reactions between the surfaces of ITO thin films and etch species.

Key Words : ITO, ICP, $O_2/BCl_3/Ar$

1. 서 론

Indium tin oxide (ITO) thin films with a proper combination of indium oxide (In_2O_3) and tin oxide (SnO_2) have a very high optical transmittance in the visible light region and high reflectivity properties in the infrared light region. The ITO film which has a low resistivity is stable oxide at room temperature. It also has a good conductivity and high productivity as well as the best transparency among the transparent oxide material. Therefore, ITO thin films have been widely used as transparent conductive electrodes in various applications, such as solar cells, gas sensors, bio sensors and flat panel displays. In this work, we investigated the etching characteristics of ITO thin film and SiO_2 as a function of the $O_2/BCl_3/Ar$ gas mixing ratio in an inductively coupled plasma (ICP) system. The chemical states on the etched surface were investigated using XPS.

2.결과 및 토의

The addition of O_2 gas to obtain the smooth surface roughness. Generally, the combination of O_2 and BCl_3 enhances etch rate of ITO thin films by forming volatile etch byproducts, such as $BClO_x$ and $In(ClO_4)_3$. It also decreases the etch rate by forming non-volatile etch byproduct of B_2O_3 and $InCl_3$. The maximum etch rate of ITO is 65.9 nm/min at 10 % of O_2 addition in BCl_3 (20 %)/Ar (80 %) gas mixing ratio. For O_2 gas addition, Cl emission intensity decreases due to recombination between Cl and O atoms. These results confirm that the etch rate of ITO films decrease due to the lower physical bombardment effect and chemical reaction. After XPS analysis, the result attributed to weakened formation between the In, Sn and oxygen atoms due to the chemical reactions of the ITO and etch reactant species.

참고 문헌

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