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Infinitely high etch selectivity during $CH_4/H_2/Ar$ inductively coupled plasma (ICP) etching of indium tin oxide (ITO) with photoresist mask

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1. Introduction

Indium tin oxide (ITO) has found many applications including flat panel display, photovoltaic devices and organic light emitting diodes (OLED) because of the ITO's excellent electrical conductivity and high optical transmittance. High etch selectivity process is useful in patterning of the ITO layers in many applications.

2. Main subject

In this study, the etching characteristics of ITO thin films, etched with a positive photoresist mask, and a etch process window in inductively coupled $CH_4/H_2/Ar$ plasmas, were investigated by varying the various process parameters such as gas flow ratio, top electrode power and dc slef-bias voltage (V_{dc}). It was found that the etch process window for ITO etching is closely related to the balance between the deposition and removal processes of *a*-C:H (hydrogenated amorphous carbon) layer on the ITO surface. Under certain conditions, the etch rate selectivity of ITO to PR was infinite, because the ITO films continue to be etched but a net deposition of the *a*-C:H layer occurs on the top of the photoresist. Process window of infinitely high etch selectivity of ITO to PR was investigated in conjunction with the Langmuir probe and plasma diagnostics using Optical Emission Spectrometry (OES).

3. Conclusion

The combined results from the various measurements on etch rate, etch selectivity, *a*-C:H layer deposition, species in the plasma, and surface chemical states by FE-SEM, OES and Langmuir probe imply that the chemical reaction of CH radicals with the In and Sn atoms in ITO and the ion-enhanced removal mechanism of the *a*-C:H layer play an important role in determining the ITO etch rate and selectivity. We could obtain infinitely high etch selectivity of ITO to PR under a certain process regime by varying the process parameters.

Reference

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2. S.W. Na *et al.*, J. Vac. Sci. Technol. A 23, (2005) 898.