Deposition of SiOC:H Films Suitable for MEMS Manufacturing

SAMCO has developed a SiOC:H film suitable for MEMS manufacturing with our unique LS-CVD® system. The system uses a TEOS liquid source, and the SiOC:H film was deposited using ion energy in the cathode-driven process.

### Wet Etch Rate Control

SiOC:H films are good for controlling wet etch rates with buffered HF(BHF). By controlling the additive O₂ and Ar flow, the wet etch rate with BHF was almost linearly-controlled. The refractive index also changed as the wet etch rate increased. As the O₂ flow ratio increased, the refractive index approached 1.46, which is the value of SiO₂ at a wavelength of 633 nm. This means the film composition was close to SiO₂ (Fig.1). The depositon carried out using only TEOS and Ar, but without O₂, has a very low wet etch rate and the resulting film is suitable as a mask in the BHF wet etching processes and for use as a barrier film.

### Evaluation of Dielectric Constant and Stress

The dielectric constants of the SiOC:H films were evaluated. With no added O₂ flow, the dielectric constant was 2.8. When the O₂ flow rate was 1 (ratio of O₂/(O₂+Ar)), the dielectric constant was 3.9. As the film composition changed from SiO₂ into SiOC:H, the dielectric constant decreased (Fig.2). When the film stress was measured, it was found to be between 300 and 400 MPa (compressive). This means the deposited film had a high density similar to that of SiO₂.

### Evaluation of Electrical Properties

The electrical properties of SiOC:H films, which were deposited without the addition of O₂, were measured (Fig.3). With further improvement of the film’s insulation properties, SAMCO SiOC:H film can be applied as an insulation layer for a MEMS sensors of pressure and gas flow.

### Summary

We developed a SiOC:H film using our LS-CVD® system. The SiOC:H film has high dielectric voltage resistance and controllable wet etch resistance properties. Therefore, we believe the SiOC:H film will be suitable for MEMS manufacturing. We will continue to develop MEMS manufacturing processes combined with our PECVD and dry etching technologies.

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LS-CVD is registered trademark (LS-CVD = Liquid Source CVD).