

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 deposition 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 400MPa (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.

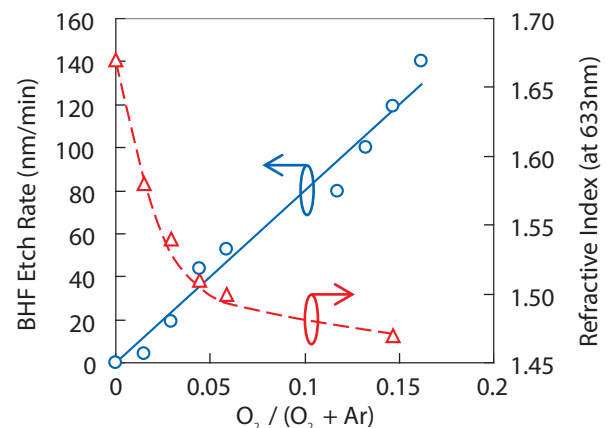


Fig.1 BHF Etch Rate and Refractive index

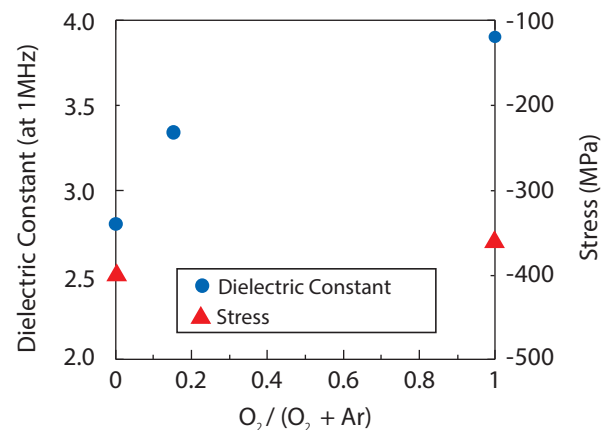


Fig.2 Dielectric Constant and Stress

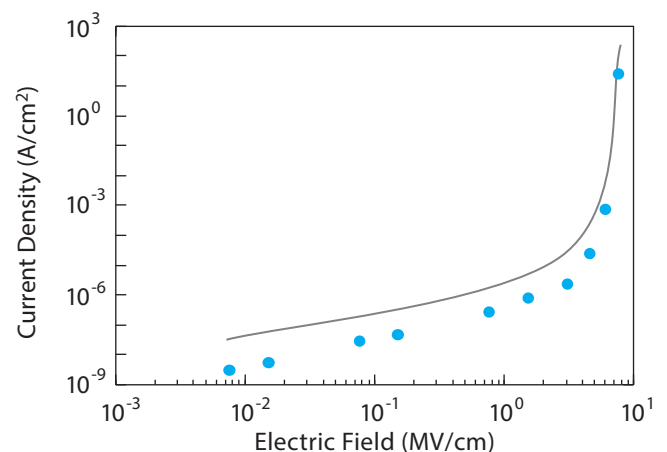


Fig.3 Electrical Properties