

Decrease of Global Warming Effect During Dry Etching of Silicon Nitride Layer Using C3F6O/O2 Chemistries

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Recently, the discharge of global warming gases in dry etching process of TFT-LCD display industry is a serious issue because perfluorocarbon compound (PFC) gas causes global warming effects. PFCs including CF₄, C₂F₆, C₃F₈, CHF₃, NF₃ and SF₆ are widely used as etching and cleaning gases. In particular, the SF₆ gas is chemically stable compounds. However, these gases have large global warming potential (GWP₁₀₀ = 24,900) and lifetime (3,200). In this work, we chose C₃F₆O gas which has a very low GWP (GWP₁₀₀ = <100) and lifetime (< 1) as a replacement gas. This study investigated the effects of the gas flow ratio of C₃F₆O/O₂ and process pressure in dual-frequency capacitively coupled plasma (CCP) etcher on global warming effects. Also, we compared global warming effects of C₃F₆O gas with those of SF₆ gas during dry etching of a patterned positive type photo-resist/silicon nitride/glass substrate. The etch rate measurements and emission of by-products were analyzed by scanning electron Microscopy (SEM; HITACHI, S-3500H) and Fourier transform infrared spectroscopy (FT-IR; MIDAC, I2000), respectively. Calculation of MMTCE (million metric ton carbon equivalents) based on the emitted by-products were performed during etching by controlling various process parameters. The evaluation procedure and results will be discussed in detail.

Keywords: C₃F₆O, Global warming potential