Process window for infinitely high etch selectivity of TEOS oxide to PVD $a$-C in dual-frequency capacitively coupled $C_4F_8/CH_2F_2/O_2/Ar$ plasmas

권봉수¹, 김진성¹, 안정호¹, 박영록¹, 정창웅¹, 허욱¹, 박지수¹, 이내웅¹, 손종원²

¹성균관대학교 신소재공학부, ²주성엔지니어링(주)

For the purpose of obtaining highly selective etching process of silicon oxide layer using a very thin amorphous carbon ($a$-C) layer, the highly selective etching of the TEOS oxide layer using physical-vapor-deposited (PVD) $a$-C mask ($\approx 50$nm) was investigated in a dual-frequency superimposed capacitively coupled plasma etcher by varying the process parameters in $C_4F_8/CH_2F_2/O_2/Ar$ plasmas: $CH_2F_2/(CH_2F_2+O_2)$ flow ratio, high-frequency power ($P_{HF}$) and low-frequency power ($P_{LF}$). It was found that a wide process window for infinitely high etch selectivities of the TEOS oxide layers to the PVD $a$-C on both the blanket and patterned wafers could be obtained for certain process conditions. And the etch gas flow ratio was found to play a critical role in determining the process window for infinite TEOS oxide/PVD $a$-C etch selectivity, due to the disproportionate change in the degree of polymerization. Etching of ArF PR/BARC (bottom anti-reflective coating)/SiO$_x$/PVD $a$-C/TEOS oxide MLR structure supported the possibility of using a very thin PVD $a$-C layer as an etch-mask layer for etching of the high-aspect ratio TEOS oxide line or contact.