

Abstract Submitted
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Performance Tunable High-Frequency Inductively Coupled Plasma Technology in Application to Polysilicon Etcher and High Density Plasma CVD¹

JONG W. SHON, Ju Sung Engineering Ltd., GICHUNG KWON, JuSung Engineering Ltd., HONG Y. CHANG, KAIST, JUSUNG ENGINEERING TEAM, KAIST TEAM — High frequency ICP plasma technology is uniquely suited for 45nm technology node and below for its ability to produce plasma with low electron temperature and controllable ion energy. In this presentation we will discuss principles of this technology and its application to Poly etcher and HDP CVD. The low impedance resonance antenna can accomplish impedance matching in 13.56 MHz or 27.12 MHz source frequency. High density plasma is generated by the high current coils. Also, plasma uniformity can be controlled by the current in each antenna turns. The low capacitive voltage applied to antenna can minimize capacitive damage and reduce particles from ceramic plate. High frequency ICP source can generate plasma with low electron temperature compared to lower frequency ICP sources using 400 KHz or 2 MHz), which can minimize plasma damage on the wafer. The plasma density from this source is $1 \times 10^{11} \sim 1 \times 10^{12} \text{ cm}^{-3}$ and the electron temperature is less than 2.5 eV in 27.12 MHz and 4 eV in 13.56 MHz. We obtained the plasma uniformity less than 5%. For the applications, patterned WSi gate, poly-Si gate, and W-Bit line wafers were etched using a parallel resonance antenna. STI (Shallow Trench Isolation), ILD (Inter Layer Dielectric), and IMD (Inter Metal Dielectric) wafers were processed in a dome-typed antenna source for HDP CVD. The process characteristics of HDP CVD has proven in 0.13 micrometer technology with AR (aspect ratio) 5:1 and expected to provide next generation gap fill solution. The process characteristics of dry etcher have obtained minimal micro-loading effect less than +5%, high selectivity W to Hard Mask (SiN) more than 1.5:1, wide range CD bias control within 20 nm, and vertical profile more than 89 degree.

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