**TT-P049**

**The characterization of low-\(k\) SiCOH etched film as a function of plasma power**

**Sungwoo Lee\(^1\), Jihyung Woo\(^1\), Seungchae Choi\(^1\), Donggeun Jung\(^1\)\(*\), Jaeyoung Yang\(^2\), Jin-hyo Boo\(^3\), Sangjin Cho\(^3\), Heeyeop Chae\(^4\)**

\(^1\)Department of Physics, Brain Korea 21 Physics Research Division, Institute of Basic Science, Sungkyunkwan University, Suwon 440-746, South Korea

\(^2\)Advanced Nano-tech Development Team, Semiconductor Business, Dongbu HiTek co., Ltd., Eumseong-Gun, Chungbuk 369-852, South Korea

\(^3\)Department of Chemistry, Sungkyunkwan University, Suwon 440-746, South Korea

\(^4\)Department of Chemical Engineering, Sungkyunkwan University, Suwon 440-746, South Korea

As integrated circuits (ICs) continue to shrink, their speed comes to be limited by their resistance × capacitance (RC) time constant, resulting in increased power dissipation and increased cross-talk in multilevel interconnects. It is necessary to replace the present interlayer dielectric SiO\(_2\) (a relative dielectric constant \(k\sim4.0\)) by materials with a low dielectric constant (low-\(k\): \(k\leq3.5\)). Many research groups are investigating the etching mechanism of low-\(k\) materials. Several research groups have reported observing plasma damage to blanket and patterned low-\(k\) dielectric films. However, to reach these goals, adjusting the standard plasma parameters (source power, bias voltage, gas mixture, pressure, etc) is not always sufficient. In this work, we reported the influence of top and bottom plasma power on the low-\(k\) SiCOH films in inductively coupled plasma (ICP) etching system. We have investigated the etch rate and electrical and chemical properties of low-\(k\) (\(k=2.8\)) SiCOH etched in CF\(_4\)/Ar(10\%), and CHF\(_3\)/Ar(10\%) plasmas as a function of inductively coupled plasma power. The power of top and bottom plasmas increased, the etch rate of low-\(k\) film increased. The higher etch rate was observed with CF\(_4\)/Ar than with CHF\(_3\)/Ar plasma. Surface and bulk properties of low-\(k\) film after etching were studied using surface analysis such as x-ray photoelectron spectroscopy (XPS) and Fourier Transform Infrared (FT-IR) Spectroscopy. The changed of the etch rate as a function of plasma power was correlated with the change of the FT-IR absorbance peaks of C-H\(_x\) and Si-O related groups. Surface roughness was investigated by AFM.

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**Silicon oxy-nitridation using the hyperthermal neutral beam (HNB)**

**김종식\(^1\), 김대철\(^1\), 손혁준\(^2\), 유석재\(^1\), 박영춘\(^2\), 이봉주\(^1\)**

\(^1\)국가핵융합연구소, \(^2\)한동대학교

Hyperthermal Neutral Beams (HNB) is drawing the attention for manufacturing future nanoscale devices owing to reducing the plasma-induced damage. We will present the characteristics of SiON films grown using the HNB with an energy of tens of eV for the gate dielectric material. The HNB generated by the inductively coupled plasma (ICP). The RF input power is 1500 W, the operating pressure less than 1 mTorr, the substrate temperature is 400 °C, and the bias voltage of the neutralization plate in a range of 0 ~ -40 V. The electrical and physical properties are measured with a metal oxide silicon (MOS) structure: Current-Voltage (IV), Capacitance-Voltage (CV) characteristics and XPS, SIMS analysis. As a result, the SiON film leakage current is 1.0E-8 A/cm\(^2\) at 6.5 MV/cm. These results support that the HNB is an extremely good method to grow the SiON film without plasma-induced damage.