P-014

AN OPTIMIZED NITRIDE RESIDUE PHENOMENA OF SHALLOW TRENCH ISOLATION (STI) PROCESS BY CHEMICAL MECHANICAL POLISHING (CMP), SANG Y. KIM, C. I. KIM, E. G. CHANG (Dept. of Elect. Eng, Chungang Univ., Seoul, 156-756, Korea), Y. J. SEO (School of Elect. Eng, Daebool Univ., Youngam, 526-890, Korea), T. H. KIM (Dept. of Elect. Yeojoo Technical Collage, Yeojoo, 469-800, Korea), W. S. Lee (Dept. of Elect. Eng, Chosun Univ., Kwangju, 501-759, Korea)

Nitride residue after STI CMP process at the specific device is the defect which can be occurred in the condition of high post CMP thickness and low trench depth. This paper is to resolve these problem, the relationship between the nitride residue and the trench depth, and between the nitride residue and post CMP thickness are analyzed.

In this work, the optimum process margin condition, post thickness in CMP process, trench depth in etch process, and over etch time in reverse moat etch process are defined. The obtained results are to know the exact occurrence point of nitride residue by analyzing the trench depth and post CMP thickness together. Nitride residue defet is closely related with both of them.

P-015

CHARACTERISTICS OF THERMAL NITRIDE GROWN BY IR FURNACE, H. SHIN, S. CHOI, and K. LEE (Dept. of Electrical Engineering, KAIST, Daejon, 305-701, Korea)

High-quality very thin films of silicon nitride were thermally grown in ammonia atmosphere with an IR gold image furnace. As-grown nitride film was analyzed using AES, which showed that the oxygen contamination was negligible. Using MIS devices, the growth rate was calculated with CV measurements and various electrical characteristics were obtained using CV, IV, trapping, time-dependent breakdown, high-field stress, constant current stress, and dielectric breakdown techniques. Thermal nitride growth was self-limited, so we could obtain very thin film with easy process control. Thermal nitride demonstrates low barrier height and yields large tunneling current at low fields. Furthermore, the dielectric breakdown field and stress-induced leakage current of thermal nitride insulator exhibit comparable or even better characteristics than those of the thermal oxide. These characteristics showed that very thin thermal silicon nitride films can be used as gate dielectrics for future highly scaled-down ULSI devices, especially for EEPROM's.

P-016

TEMPORAL AGING OF SiO_2 XEROGEL THIN FILM FOR INTERMETAL DIELECTRIC APPLICATION, J.H. KIM and H.H. PARK (Dept. of Ceramic Eng., Yonsei Univ., 134 Sinchon-dong, Seodaemun-ku, Seoul 120-749, Korea)

In ultra large scaled integration, new ultra low dielectric material is needed to reduce resistance-capacitance delay. Low density SiO_2 xerogel film is a novel material of lower dielectric constant compared to conventional SiO_2 film. Theoretically, dielectric constant depends on the porosity, for example, dielectric constant of a film with 50% porosity is about 2.5. Therefore, a major issue for xerogel films is the porosity due to its inherent porous nature. After gelation but before complete drying, the chemistry and structure of a gel may be dramatically altered by varying aging time in a process called aging. During aging, terminal Si-OR and Si-OH groups will continue to condense to form Si-O-Si plus either ROH or H_2O by-products. Consequently, the porosity of SiO_2 xerogel thin film prepared using a sol-gel technique could be controlled by temporal aging of SiO_2 wet-gel and the increase in microstructural strength of SiO_2 xerogel film could be also obtained. In this work, we have studied the microstructural changes and properties in which SiO_2 xerogel films were prepared by varying the aging time using mixed solutions of ethanol and tetraethoxysiliane. The density and porosity of the films was determined using Rutherford backscattering spectroscopy and scanning electron microscopy. And the composition and surface bonding states were evaluated by X-ray photoelectron spectroscopic and Fourier transformed - infrared spectroscopic analyses.

P-018

MICROSTRUCTURE AND DIELECTRIC PROPERTY OF ECRCVD a-C:H:F/a-C:H FILMS FOR LOW-k INTERLAYER DIELECTRICS, SUNG-HOON YANG, Seoghyeong Lee, Jeongwon Park, *Jung-Yeul Kim and Jong-Wan Park (Dept. of Metallurgical Eng., Hanyang Univ., Seoul 133-791, Korea, *Dept. of Semiconductor Eng., Uiduk Univ.,Kyungju, 780-713, Korea)

As device geometry shrinks, ULSI circuits need interlayer dielectric materials of a very low dielectric constant to solve problems of RC delay which limits operating speed of devices due to increases in parasitic resistance and capacitance in multilevel interconnections. Amorphous hydrogenated carbon (a-C:H) films were used as a buffer layer between the SiO_2 substrate and a-C:H:F to improve adhesion. a-C:H:F/a-C:H films were deposited on p-type Si(100) by ECRCVD from C_2F_6, CH_4 and H_2 gas sources to investigate the effect of forward power and deposition temperature on the optical properties, microstructure and stress of a-C:H:F films as an interlayer dielectric for ULSIs. Ellipsometry, FTIR, XPS and thin film stress-measurement system were used for determination of film thickness, refractive indexes, chemical bonding and film stress at various temperatures. The dielectric constant and stress in the a-C:H:F/a-C:H films were found to decrease with increasing flourine concentration. This behavior suggests that a-C:H:F/a-C:H having lower k are characterized by lower stresses.

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