P-023

ANALYSIS OF ETCHED SILICON SURFACE FOR TRENCH ISOLATION TECHNIQUES, S. G. KIM, J. KIM, J. W. LEE, T. M. RHO, J. G. KOO, and K. S. NAM (Semicon Div. ETRI, Daejon, 305-600, Korea)

This paper presents a trench etching and filling technique used to make isolation structure for power ICs. This technique consists of a deep trench formation (8.5 μm) with positive etching using the HBr/SiF_4 with 45% in He/O_2 chemistries and global planarization after trench refill techniques using chemical mechanical polishing (CMP).

Experimental results show that adding O_2 and other additive gases into HBr plasma makes it possible to eliminate sidewall undercutting and to lower surface roughness. Passivation layer of lateral etching was mainly composed of SiO_xF_y and SiO_xBr_y. Etch induced defects were found in the edge region of trench bottom with depth of 10Å and decreased at the trench sidewall region. The novel trench etching technique provides better surface quality of 3Å roughness of atomic force microscopy (AFM). The global planarization after trench refill techniques was carried out by using a new chemical mechanical polishing (CMP) technique. Better leakage current characteristics of less than 1nA at supplying voltage of 400V across the trench isolation structure was observed for smart power ICs. Therefore, this technique can be applied to the isolation of power integrated circuits.

P-024

EFFECT OF THE ROUGHNESS OF SUBSTRATE SURFACE ON LOW-TEMPERATURE SILICON EPITAXIAL FILM GROWTH, SUNG KU KWON, DONG HO KIM and DO HYUN KIM (Dept. of Chemical Engineering. KAIST, Taejon, 305-701, Korea)

In-situ UV-excited NF_3/H_2 gas phase cleaning for native oxide removal and low-temperature silicon film growth were carried out sequentially in the load-locked reactor equipped with a UV lamp and a PBN heater. Main etching species were identified by mass spectrometry as F, NF_X, and HF and by-products as NO_2 and SiF_3. Hydrogen added to NF_3 gas scavenges F, which is converted to HF, so that it prevents excessive etching of silicon and alleviates surface pitting. The cleaning condition is, therefore, considered to control the morphology or the roughness of cleaned surface. In turn, the roughness of the cleaned substrate surface influences the quality of film grown upon it. Effects of surface roughness on the quality of silicon film including the defects in the film and at the interface is presented. Cross-sectional transmission electron microscopy and atomic force microscopy have been employed for the characterization of the film..

P-025

AFM AND TEM STUDIES OF TWO-DIMENSIONAL DOPANT PROFILES BY USING OF SELECTIVE CHEMICAL ETCHING

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Characterization of dopant profiles in semiconductor devices is becoming more important for fabricating very - large-scale-integrated (VLSI) devices. Although a number of delineation studies of two-dimensional (2D) dopant profiles have been reported, the spatial resolution reported in previous studies was insufficient for characterizing submicron silicon devices. In this work, AFM and TEM have been used to assess 2D dopant profiles in MOSFETs with 2 μm, 1.5 μm, and 1 μm gate length. The major technique is based on the selective chemical etching of doped regions in silicon using a $HF:HNO_3$ chemical mixture. This etching results in the local variations in crystal thickness giving rise to the appearance of thickness fringes. Such fringes could be interpreted as 2D iso-concentration contours that map the dopant distribution. The results have been compared with SIMS results and simulated data provided by SUPREM-IV which is one of the most popular 2D process simulator.

P-026

PHOTO LUMINESCENCE SPECTRA OF PRROUS SILICON TREATED BY CARBON TETRACLORID AND ALCOHOLOS, Leonid A. Balagurov, Boris M. Leiferov, Institute of Rare Metals, Tolmachevsky 5, 109017 Moscow, Russia) and Galina K. Ippolitova (ELLINA-NT, R&D Co., Dm. Ulianova st. 1/61, ap. 179, 117333, Moscow, Russia)

The different temperature treatment effects on samples of Porous Silicon (both as-prepared and ancient) by CCl_4, monatiomic alcohols and glycerine were investigated. Some methods of photoluminescence Fourier spectroscopy and X-ray structure analysis have been applied.

It was detected that the treatment of Porous Silicon by glycerine and monatomic alcohols extinguishes the photoluminescence in the band 0.85-0.9 mcm whereas by short wave band remains unchanged. The treatment by CCl_4 strongly increases the photoluminescence intensity in long-wave band. The immersion in CCl_4 stimulates the reconstruction of photoluminescence after extinguishing in alcohol, and substantially shows down the processes of interaction of Porous Silicon surface with alcohols and water. It also protects from quick thermal oxidation.

The photoluminescence mechanisms were discussed on the basis quantum effects in nanometer crystallines. Some possible impacts of surface effects are also considered.

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