The Impact Of Organic Contamination On The Oxide-Silicon Interface

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ABSTRACT

In this work, we carried out a set of experiments to investigate the impact of organic contamination on the electrical properties of the oxide-silicon interface. Some wafers were contaminated by immersion in solution of diethylphthalate in solvent. The wafers were then oxidized to perform surface recombination velocity measurements by Elymat, and capacitors were fabricated for capacitance vs. voltage and capacitance vs time measurements. In addition, the interface state density was measured by the MOS-DLTS technique and the gate oxide integrity was evaluated by constant current stress.

Elymat measurements of surface recombination velocity show that surface recombination velocity is increased by organic contamination (see fig. 1). Strong non-homogeneities are observed in contaminated wafers.

Vice versa no impact of organic contamination could be detected on oxide charge and surface generation velocity by capacitance vs. voltage and capacitance vs. time measurements.

From the point-of-view of the intrinsic properties of the oxide-silicon interface, MOS-DLTS showed the most significant effects, in that these measurements allowed identifying a band of interface states located around E_v +0.1 eV as related to organic contamination (see fig. 2). Large within-wafer variations were observed by MOS-DLTS, consistently with Elymat maps of surface recombination velocity.

However, the most relevant effects of organic contamination were observed by electrical stress of the oxide. Indeed, the fraction of capacitors with degraded breakdown voltage increased dramatically in contaminated wafers (see fig. 3).

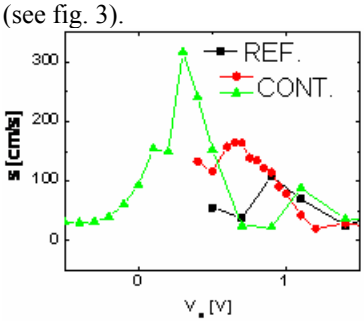


FIGURE 1. Surface recombination velocity s as a function of the surface voltage V_s in reference and contaminated wafers.

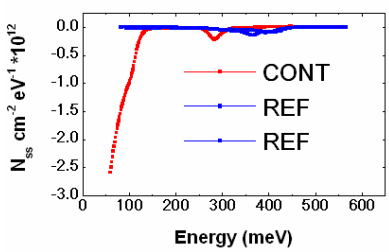
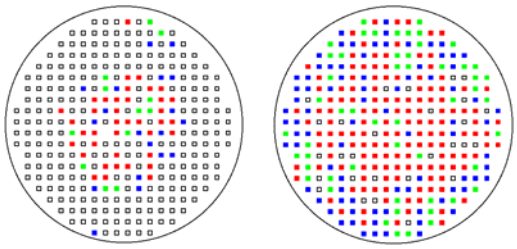


FIGURE 2. MOS-DLTS spectra of reference and contaminated samples.



Failed at 9.5 MV/cm Failed at 10.6 MV/cm
Failed at 12 MV/cm

FIGURE 3. GOI maps of reference and contaminated samples.

Keywords: Organic Contamination, MOS-DLTS, GOI

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