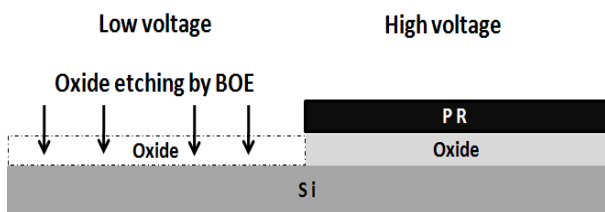


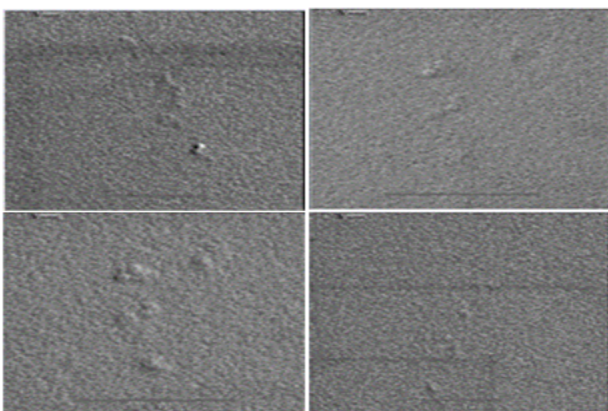
Title : Micro unetched oxide defect during Buffered Oxide Etchant process  
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NAND Flash is partitively used as divided two regions, High Voltage(HV) Oxide and Low Voltage(LV) Oxide, to improve program speed and reliability. General method for this division is pattern blocking using Photo Resistor (PR) followed by etching LV oxide with Buffered Oxide Etchant(BOE).



[Fig.1] Segregate oxide into HV and LV region

As widely known BOE usage is due to its high oxide etch rate, and excellent chemical for maintaining characteristic of the PR blocking mixture of HF (Hydrofluoric Acid) and NH<sub>4</sub>F(Ammonium Fluoride). BOE is used by adding surfactant to improve characteristics of low particle adhesion, control of Surface micro roughness, etching uniformity and Good wettability.



[Fig.2] SEM Image : unetched Oxide Defect

But, recently, F1x devices are mass-produced, 0.2um sized unetched defects by oxide etching with BOE is newly detected. Partial oxide unetched defects in low voltage oxide region causes tunnel oxide gets thicker and adversely affects electron's tunneling.

As a result program & erase speed decline on the relevant transistor, and it causes yield drop by the characteristic breakdown.

As possible causes of the oxide unetched defects, micro impurities in chemical source or micro bubble by surfactant is suspected, but exact root cause is not known yet. In order to improve relevant defects, we approached two ways such as improvement of chemical contamination and the process recipe.

First, chemical contamination is improved by reducing size of BOE chemical circulation filter and shortened replacement period.

Second, apart from improvement to chemical contamination, the recipe with optimized condition was developed and implemented.

As a result, chemical contamination improvement primarily prevents the defects, improved recipe can minimize secondary damages by the defects even though BOE is contaminated .

As products shrinks new defects are detected which we have not ever faced with. Not only the process condition or facilities, but also research or management of the chemical source will be crucial point from now on.