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OXIDATION-INDUCED STACKING FAULT IN (100) AND (111) SILICON WAFERS

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Dissertasi diserahkan untuk memenuhi sebahagian keperluan bagi ijazah sarjana teknologi sains bahan

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ABSTRACT

Oxidation-induced stacking fault (OISF) dimension and density change on (100) and (111) wafers, as a result of repeated preferential etching were studied using AFM, optical microscope and angular polishing techniques. Density on (100) and (111) wafers is independent of surface removal up to 3.0μm. This indicates the single layer nature of OISF formed from the sand blasted wafer. Besides having higher density, OISFs from (100) wafer were longer than OISF from (111) wafer. OISF width increases linearly with surface removal however the length does not change significantly with surface removal. In the OISF normal depth studies using angular polishing technique, OISF depth on (100) wafer is double of those on (111) wafer, regardless of wafer sand blasting pressure. At lower blasting pressure, OISF density of (100) wafer is higher than (111) wafer because energy required to displace silicon atoms from (100) surface is much lower compared to (111) wafer's. When blasting pressure is increased to higher level, OISF density on (100) wafer saturates because all displaceable surface atoms had been displaced from their lattice. However for (111) wafer blasted at higher blasting pressure, displaceable surface atoms on (111) wafer are still available due to its higher surface packing density. Therefore when OISF density of (100) wafer saturates, OISF density of (111) wafer still presenting a linearly increasing trend until it overtakes (100)'s OISF density.

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DEFINITION OF ABBREVIATION

No	Abbreviation	Definition
1	FCC	Face-Centered Cubic
2	OISF	Oxidation Induced Stacking Fault
3	BSD	Back Side Damage
4	SF	Stacking Fault
5	DZ	Denuded Zone
6	HF	Hydrofluoric Acid
7	O_2	Oxygen
8	IG	Intrinsic Gettering / Internal Gettering
9	EG	Extrinsic Gettering
10	CZ	Czochralski (ingot growing method)
11	BMD	Bulk Micro Defect
12	HNO_3	Nitric Acid
13	CH_3COOH	Acetic Acid
14	DI water	De-ionized water
15	AFM	Atomic Force Microscope
16	SEM	Scanning Electron Microscope
17	SPM	Scanning Probe Microscope
18	STM	Scanning Tunneling Microscope
19	kpc/cm^2	kilo pieces per cm^2 of wafer surface area

LIST OF ANALYTICAL INSTRUMENTS USED

No	Name	Purpose
1	Optical Microscope	For OISF density counting, and OISF depth from wafer surface measurement.
2	Atomic Force Microscope (AFM)	For OISF size change determination in between repeated etching.
3	Scanning Electron Microscope (SEM)	For fault plane inclined / tilting angle measurement.

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