AN 339

SIMS Detection Limits of Selected Elements in Si and SiO_2 Under Normal Depth Profiling Conditions

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Discussion

SIMS is a powerful analytical technique which allows detection of all elements from H to U with excellent sensitivity. The table provides a list of typical detection limits for impurities in Si and SiO_2 matrices. These detection levels are for normal depth profiling conditions of blanket wafers. Detection levels for device samples depends on the size of the available analysis area.

Detection Limits in Si

O_2^+ Primary Ion Beam Positive Ions		Cs^+ Primary Ion Beam Negative Ions		Cs^+ Primary Ion Beam Positive Ions (MCs^+)	
Element	DL (atoms/cm^3)	Element	DL (atoms/cm^3)	Element	DL (atoms/cm^3)
He	5E+17	H	1E+17	Ar	1E+17*
Li	5E+12	B	1E+15	-	-
B	2E+13	C	1E+16	-	-
Na	5E+12	N	1E+15	-	-
Mg	5E+12	O	5E+16	-	-
Al	2E+13	F	5E+15	-	-
K	5E+12	P	1E+14	-	-
Ca	1E+13	S	1E+15	-	-
Ti	1E+13	Cl	5E+15	-	-
Cr	2E+13	Cu	2E+15	-	-
Mn	2E+13	As	5E+13 – 2E+15	-	-
Fe	5E+13 – 2E+15	Ge	2E+14	-	-
Ni	5E+14	Sb	1E+14 – 2E+15	-	-
Cu	2E+14	Au	5E+13	-	-
Zn	5E+15	-	-	-	-
As	5E+16	-	-	-	-
Mo	1E+14	-	-	-	-
In	5E+13	-	-	-	-
Ta	5E+14	-	-	-	-
W	2E+14	-	-	-	-

* Assuming Ca level is below 1E15 at/cm

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Detection Limits in SiO_2

O_2^+ Primary Ion Beam Positive Ions		Cs^+ Primary Ion Beam Negative Ions	
Element	DL (atoms/cm^3)	Element	DL (atoms/cm^3)
Li	1E+13	H	1E+18
B	5E+13	C	2E+17
N	2E+17	N	3E+16 – 2E+17[1]
Na	2E+13	P	1E+15
Mg	2E+13	S	1E+16
Al	1E+14	Cl	1E+16
K	1E+13	Cr	2E+16
Ca	5E+13	Fe	3E+16
Ti	5E+13	Ni	3E+15
Cr	2E+13	Cu	2E+15
Mn	1E+14	As	2E+15
Co	2E+14	Ge	2E+15
Fe	2E+14 – 5E+14	Au	1E+15
Ni	1E+15	-	-
Cu	5E+14	-	-
Zn	3E+15	-	-
As	2E+16	-	-
Mo	5E+14	-	-
In	2E+14	-	-
Ta	5E+15	-	-
W	5E+15	-	-

Note: For dynamic sector O_2^+ Primary Ion Beam sputtering, the maximum oxide layer thickness should be less than 1.5µm for proper charging compensation
[1]Higher detection limit for BPSG

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