



AN 339

SIMS Detection Limits of Selected Elements in Si and SiO₂ 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 SiO₂ 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

Detection Limits in SiO₂

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 O₂⁺ Primary Ion Beam sputtering, the maximum oxide layer thickness should be less than 1.5µm for proper charging compensation

¹Higher detection limit for BPSG

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