SEMILAB

SEMICONDUCTOR CHARACTERIZATION SYSTEMS

Wafer Mapping Tools for high speed, high resolution whole wafer mapping of defects and/or contaminants

Bulk Microdefect Analyzer for imaging of extended defects (from 20nm to several micron)

Deep Level Spectrometer for identification of electrically active point defects

WAFER MAPPING TOOLS

WT-2000 Wafer Tester

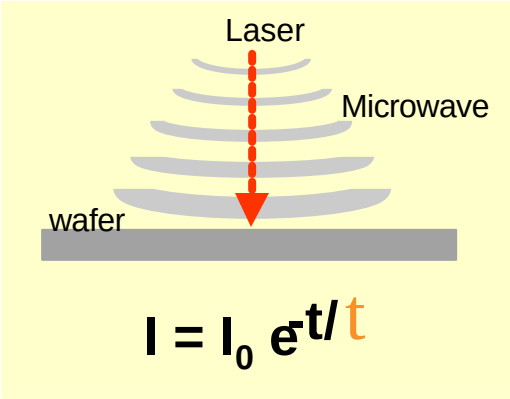
monitoring defects and contamination both in the bulk and in the surface region of silicon wafers

Applied measurement techniques:

μ-PCD	for bulk Si
Charge-PCD	for bare wafers
EpiTest	for epi wafers
Temperature dependent μ-PCD	for Si and compound materials
SPV	for bulk Si
Kelvin Probe	for oxide characterization
Eddy current	for resistivity mapping
LBIC	for solar cell characterization

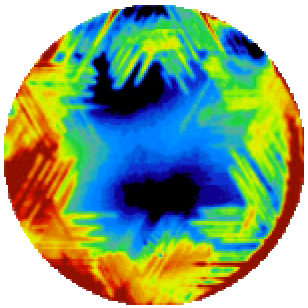
WT-2000 μ-PCD TOOL

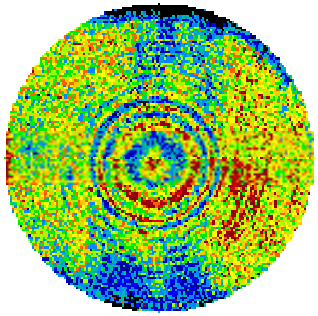
μ-PCD (microwave photoconductive decay) technique for mapping crystal growth and process induced defects and heavy metal contamination in bulk silicon wafers

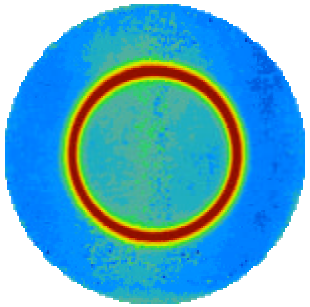


APPLICATIONS

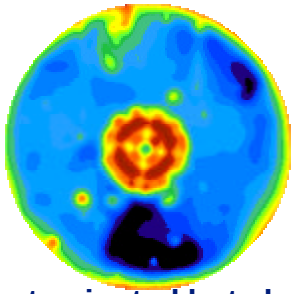
CRYSTAL GROWTH DEFECTS

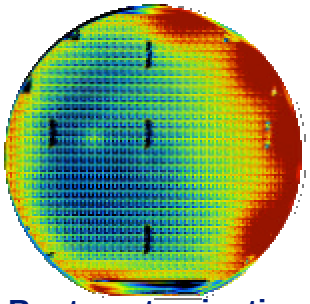

Slip lines

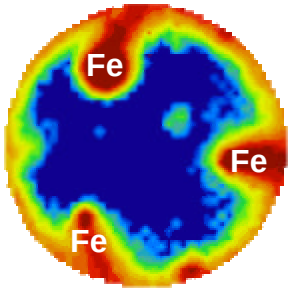

Oxygen striations


OSF ring

PROCESS INDUCED DEFECTS/Fe MAPPING


Contaminated hot chuck

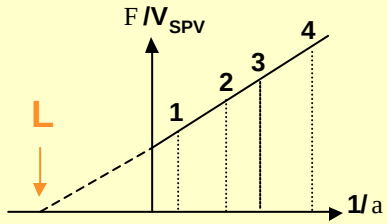

Boat contamination



Fe detection

WT-2000 SPV TOOL

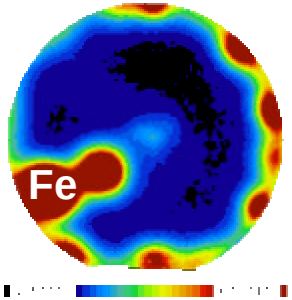
Surface Photovoltage (SPV) technique for mapping heavy metal contamination and crystal defects in the bulk silicon wafer



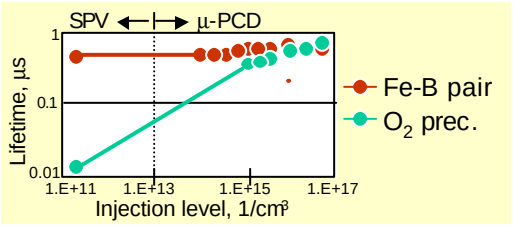
$$\frac{F}{V_{SPV}} = C(L + 1/a)$$

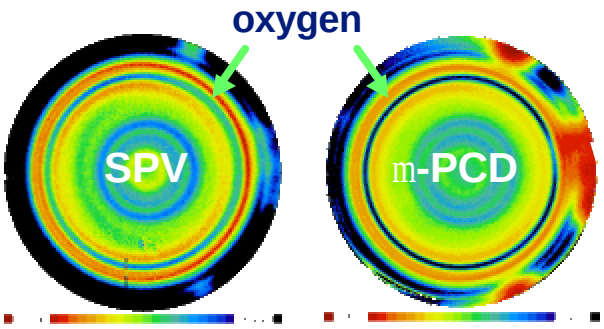
IRON CONCENTRATION MAPPING

$$N_{Fe} = C\left(\frac{1}{L_{after}^2} - \frac{1}{L_{before}^2}\right)$$



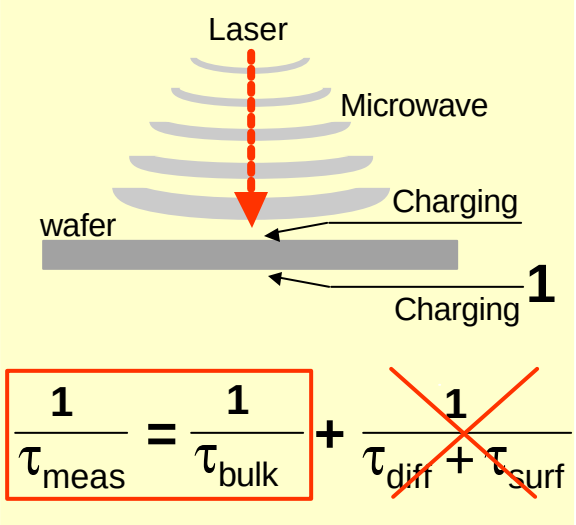
Fe AND O_2 MONITORING BY COMBINED m-PCD AND SPV TECHNIQUES





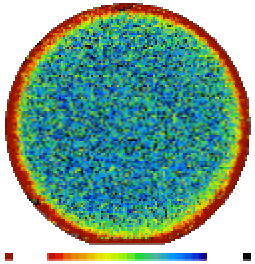
WT-2000 Charge-PCD

Semilab's patented **new surface passivation method** applying controlled charge deposition on to the wafer surface during lifetime mapping provides a highly efficient, reproducible and homogeneous surface recombination elimination on bare wafers.



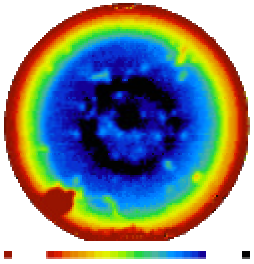
Lifetime map measured

without charging



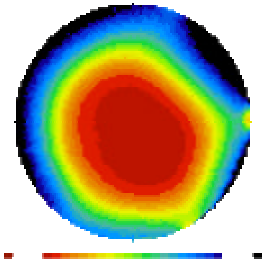
$\tau_{average}$=15.7 µs

with charging



$\tau_{average}$=268 µs

Surface /interface characterization



Interface recombination velocity map of an oxidized wafer calculated from the lifetime map measured with and without charging on the same wafer

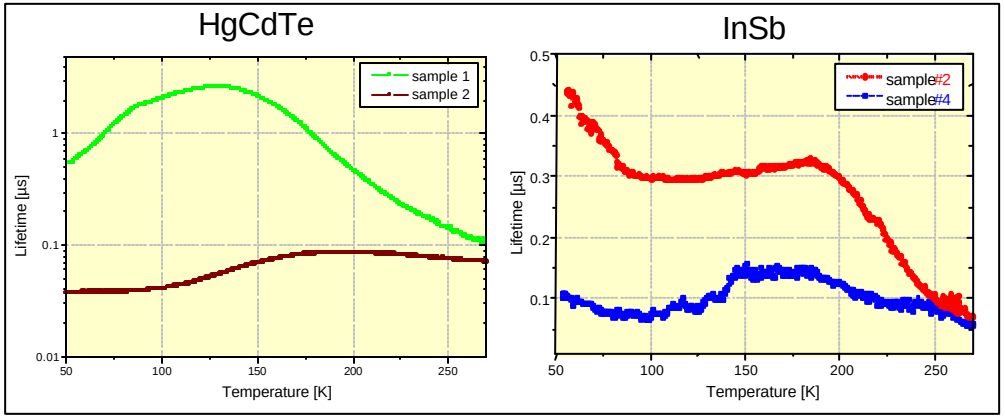
WT-2000 MCT
TEMPERATURE DEPENDENT LIFETIME

Monitoring minority carrier lifetime as a function of temperature in narrow band gap semiconductors (InSb, HgCdTe, etc.)

Two measurement strategies:

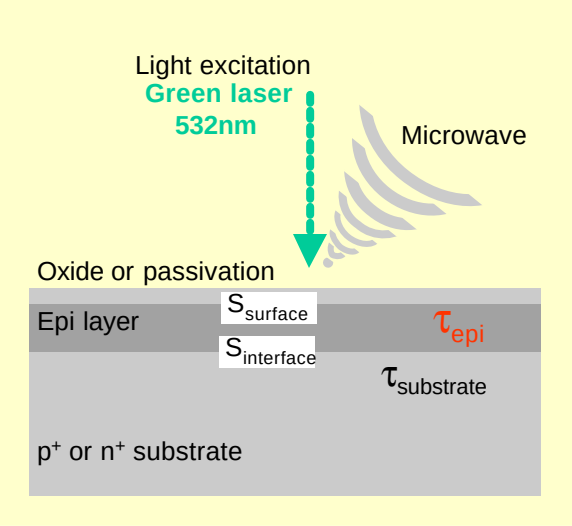
- whole wafer mapping at a preselected stabilized temperature between 85K and 300K
- single point lifetime plot as a function of temperature between 85K and 300K

Temperature dependent carrier lifetime measurements

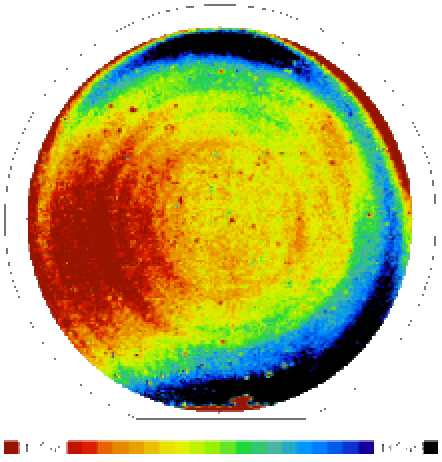


WT-2000 EPITEST

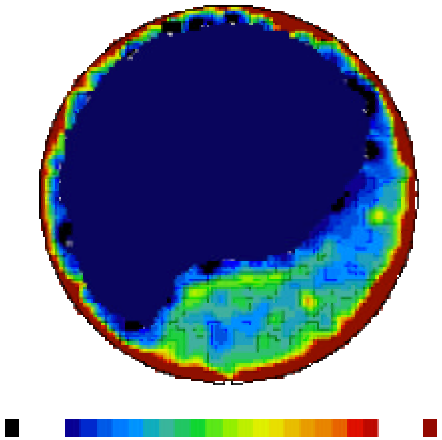
Improved μ**-PCD** (microwave photoconductive decay) technique for the characterization of recombination processes in epi structures.



Lifetime map

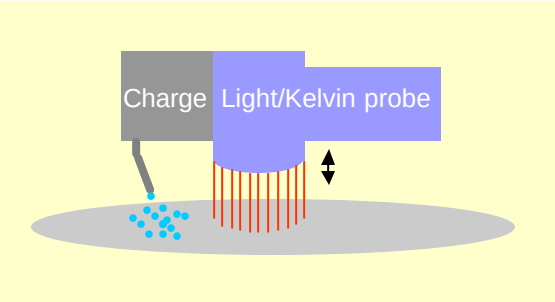


Fe concentration map



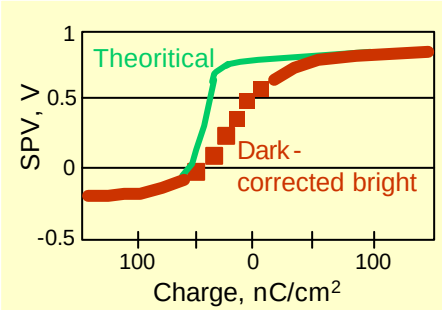
WT-2000 V-Q TOOL

Plasma damage monitoring and oxide/interface characterization by **non-contact V-Q** curve measurement using Kelvin Probe with additional high intensity illumination and controlled corona charging



Plasma damage monitoring by oxide charge map

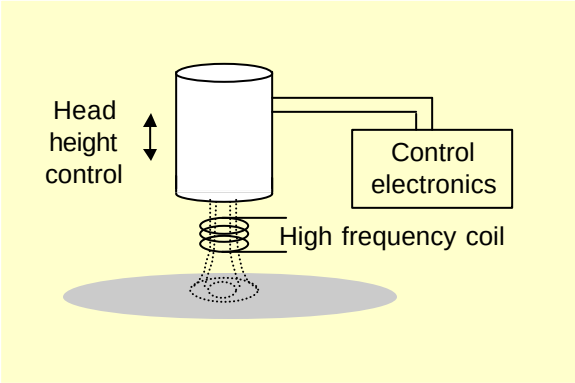
Non-contact V-Q



T_{ox}	Electrical oxide thickness
Q_{eff}	Effective charge
V_{fb}	Flatband voltage
V_t	Threshold voltage
V_{ox}	Oxide voltage
D_{it}	Density of interface traps

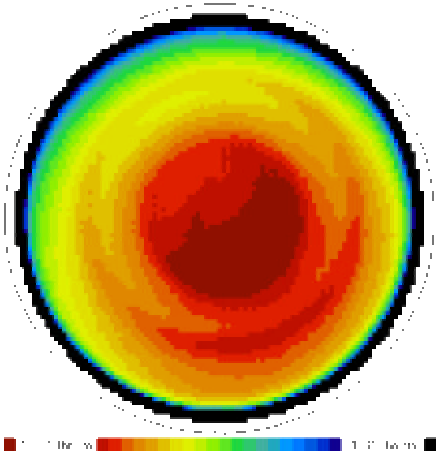
WT-2000 RESITIVITY MAPPER

Non-contact whole wafer resistivity mapping based on the eddy current technique for the determination of bulk resistivity distribution in silicon wafers

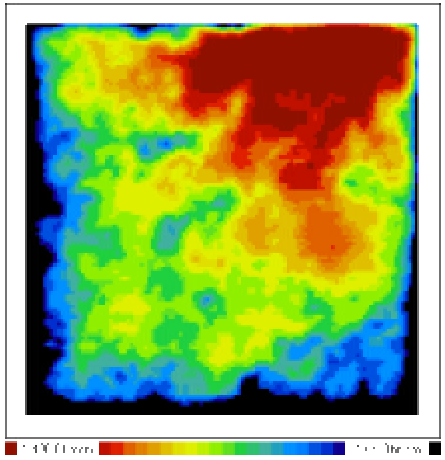


Resistivity map

Single crystal
8” CZ wafer

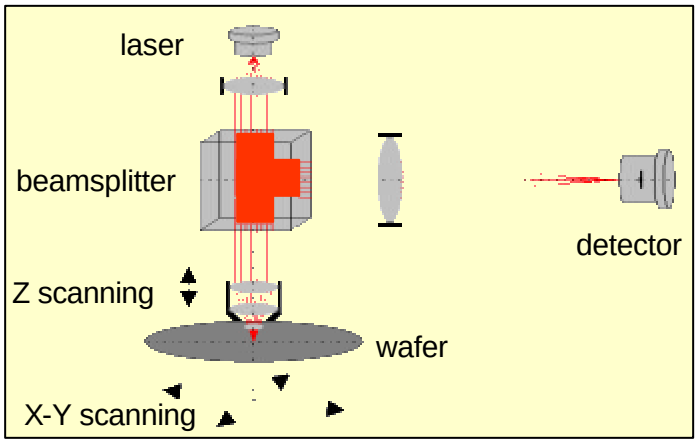


Multi-crystalline
PV material

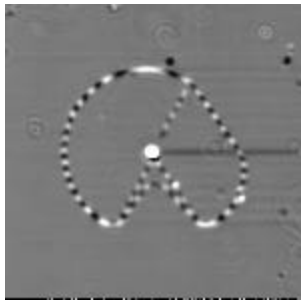


SIRM-300
BULK MICRODEFECT ANALYZER

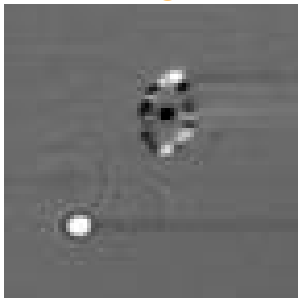
Non-contact, non-destructive method based on reflection mode confocal microscopy for detection and analysis of bulk microdefects



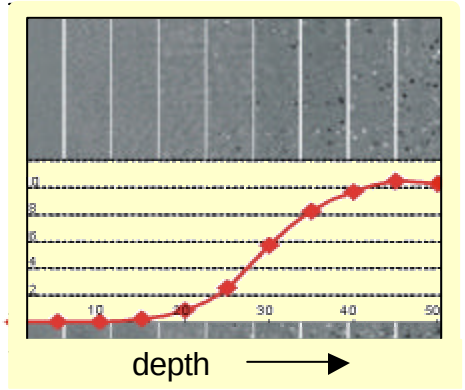
Dislocations



Stacking fault



Denuded zone determination

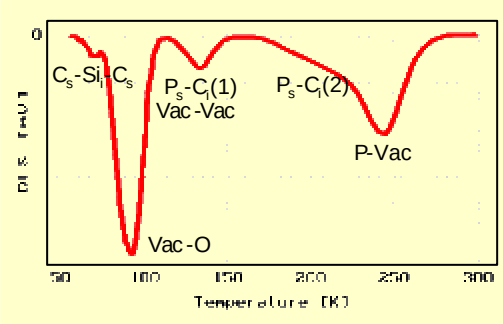


DLS-83D
DEEP LEVEL SPECTROMETER

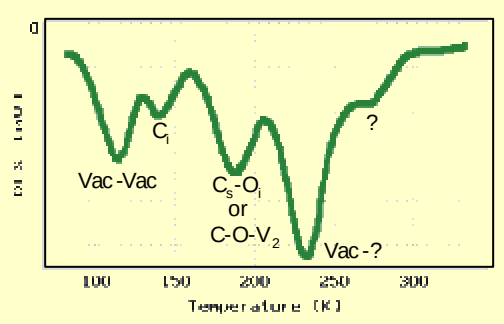
Detection and identification of trace level of impurities in concentrations down to 10^9 atoms/cm^3

Radiation defects

in n-type FZ silicon



in p-type FZ silicon



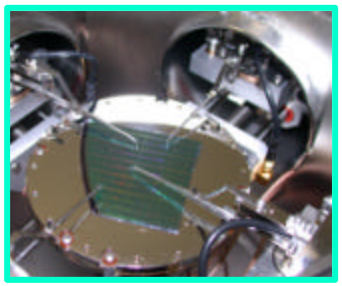
CRYOSTATS

IN DIFFERENT TEMPERATURE RANGES

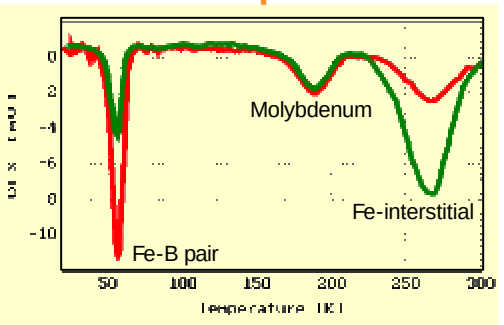
- Closed Cycle He-cryostat from 20K to 300K
- LN_2 cryostats from 77K to 450K:
  simple bath type LN_2 cryostat
  automatic LN_2 cryostat with controlled LN_2 flow

SAMPLE HOLDER

with motor driven positioning



Influence of annealing on Fe-B pairs



LBIC=Light Beam Induced Current

Very high, 1µm resolution mapping capability to measure at low temperatures
Major application: **HgCdTe** devices