

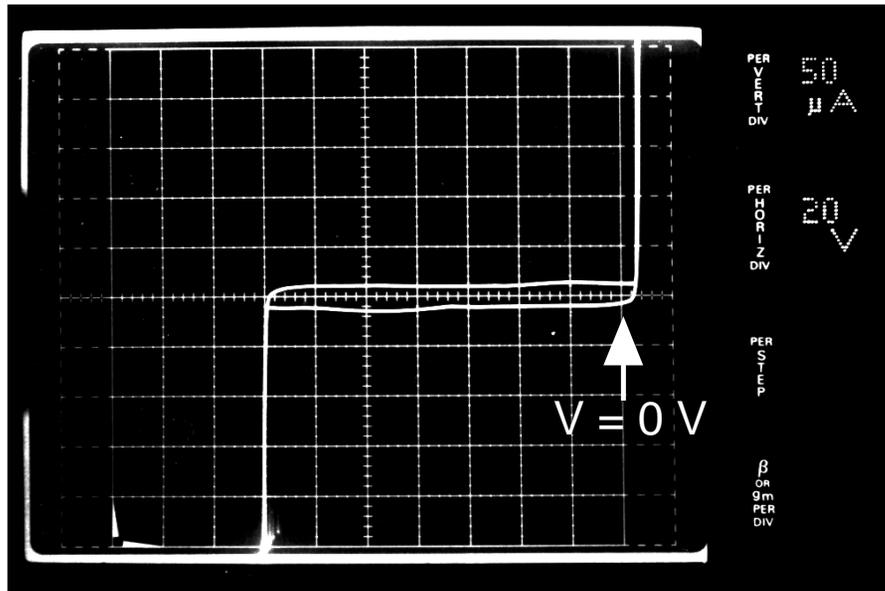


A Tale of Two Diodes

(Part 1: DC Testing)

Epitaxial Small-Area 4H-SiC p⁺n Diodes

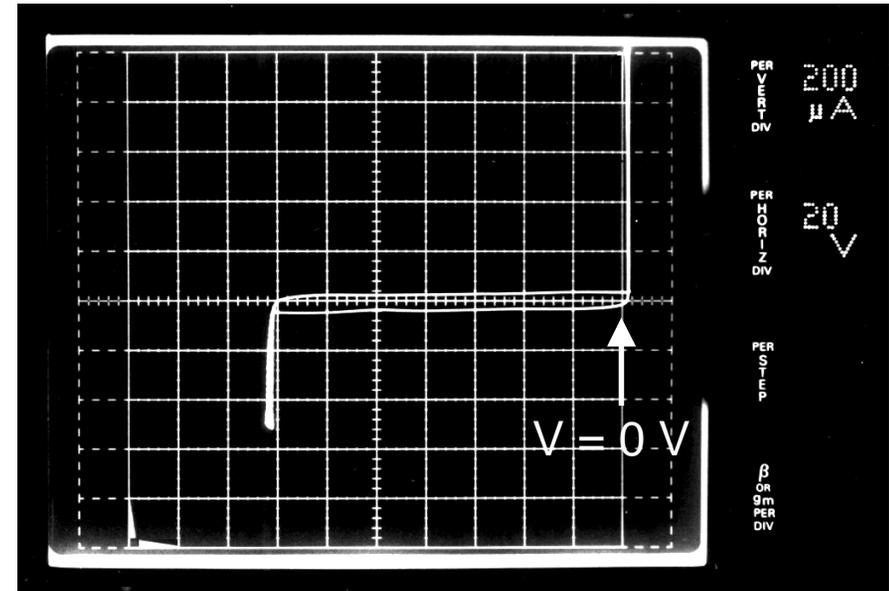
Wafer A*



$$V_{DC \text{ BKDN}} = 140 \text{ V}$$

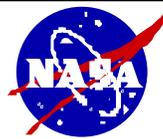
* NASA Lewis Run #1841
J. Appl. Phys. **80**, p. 1219

Wafer B**



$$V_{DC \text{ BKDN}} = 142 \text{ V}$$

** NASA Lewis Run #1905
IEEE EDL **18**, p. 96

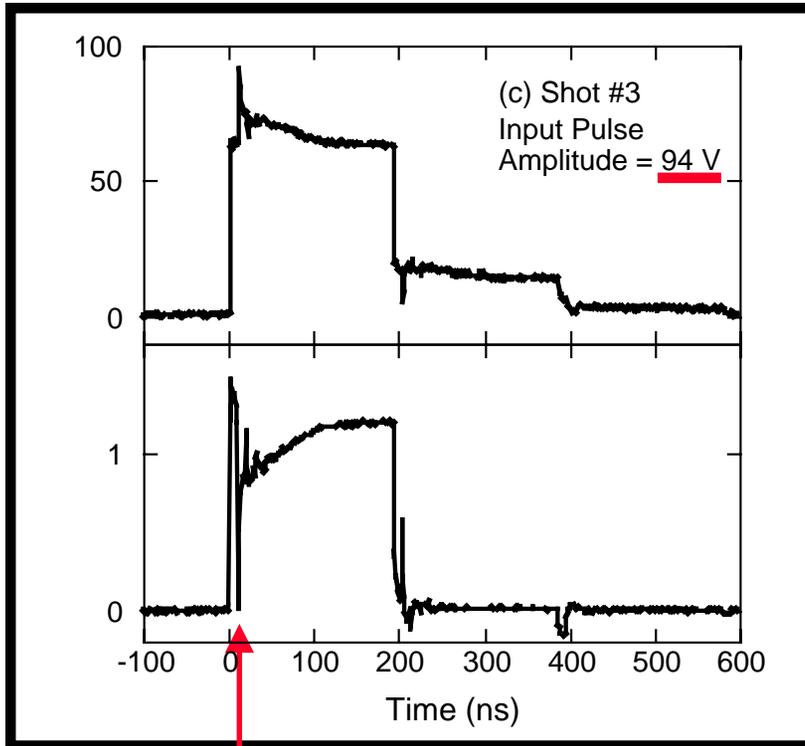


A Tale of Two Diodes

(Part 2: Reverse Bias Pulse Testing)

Wafer A

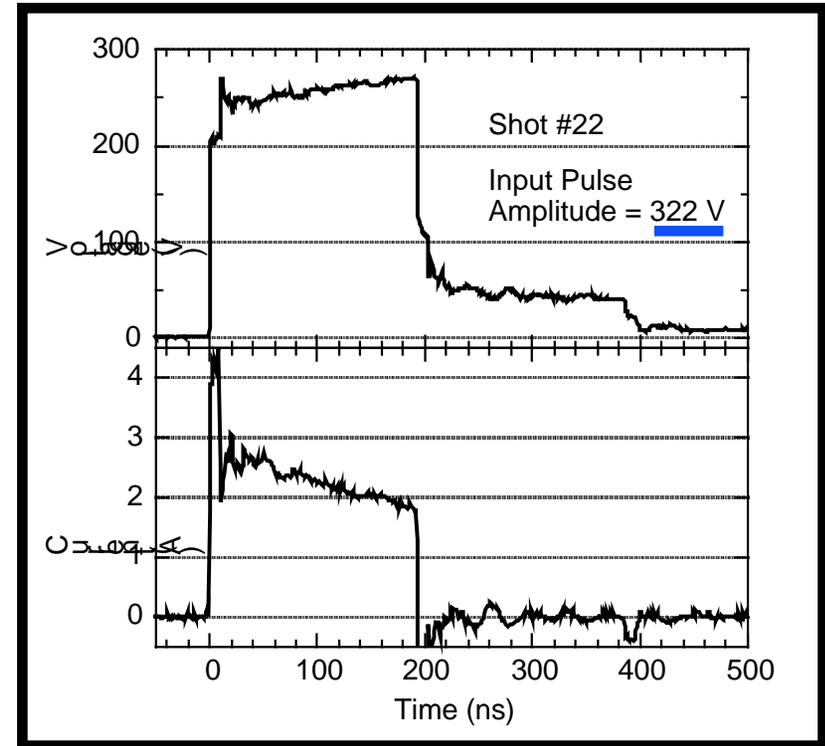
($V_{DC\ BKDN} = 140\text{ V}$)



**Catastrophic Device Failure,
Device Physically Destroyed!**

Wafer B

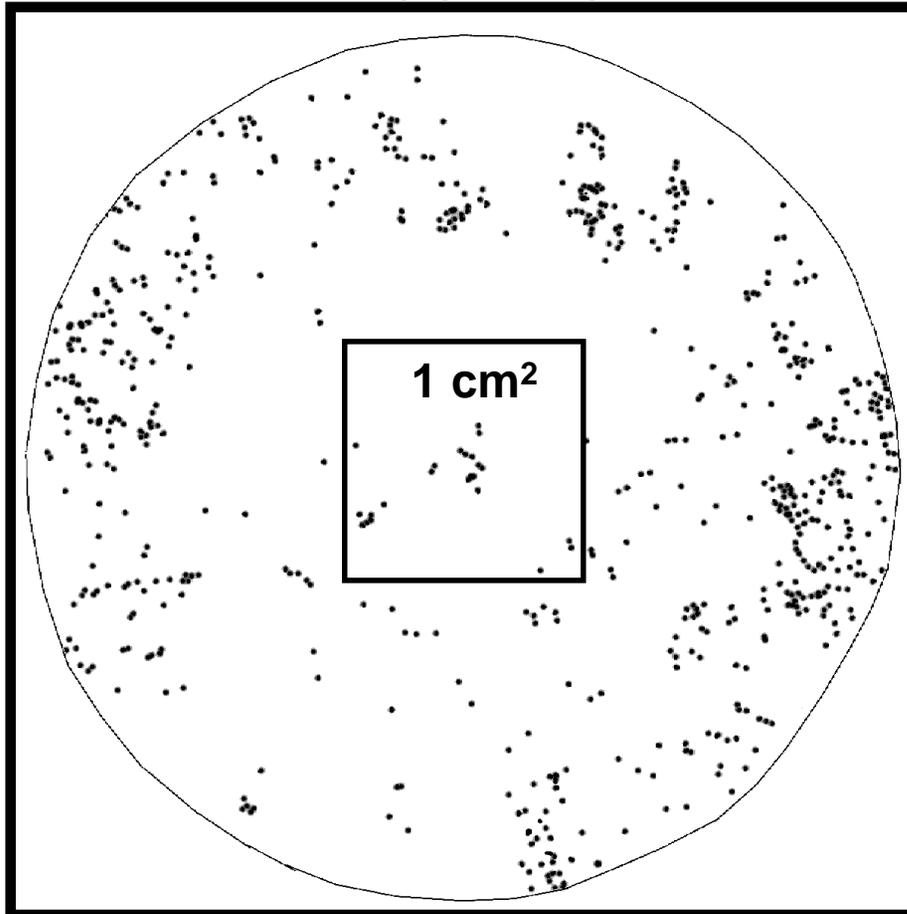
($V_{DC\ BKDN} = 142\text{ V}$)



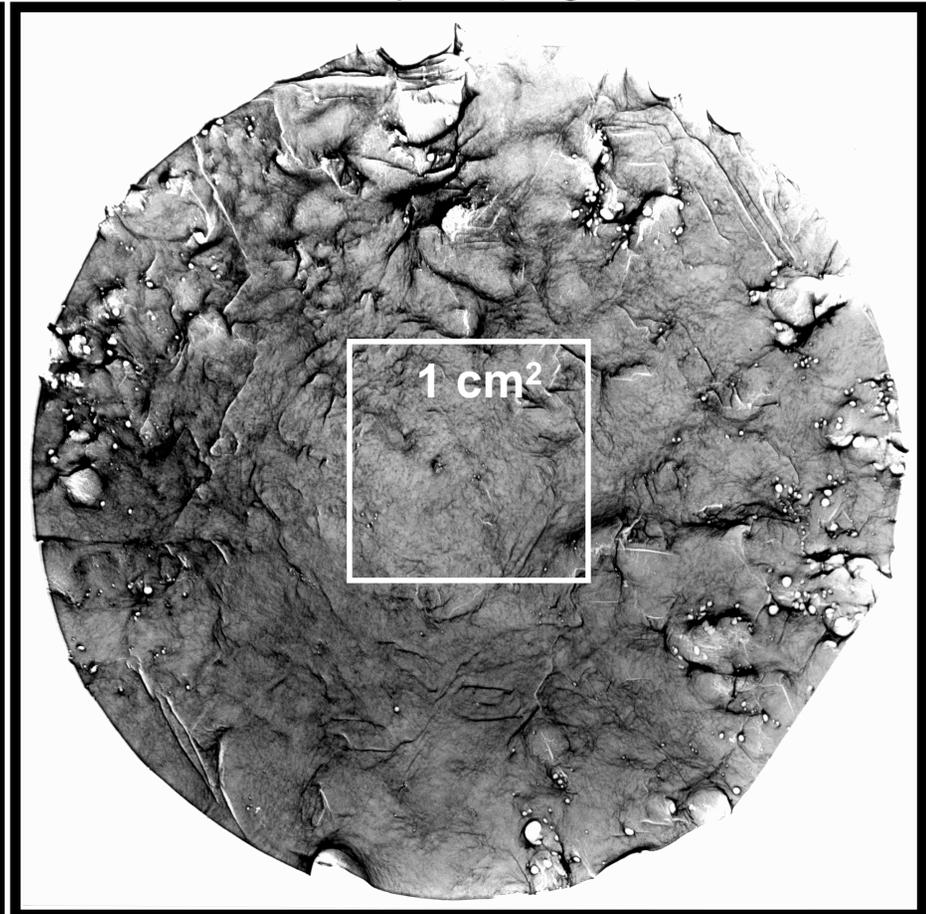
**Device Still Good,
Positive Temp. Coeff. Breakdown!**

Cree "Low Micropipe" ($< 30 \mu\text{pipes}/\text{cm}^2$) Grade 35 mm Wafer

Micropipe Map

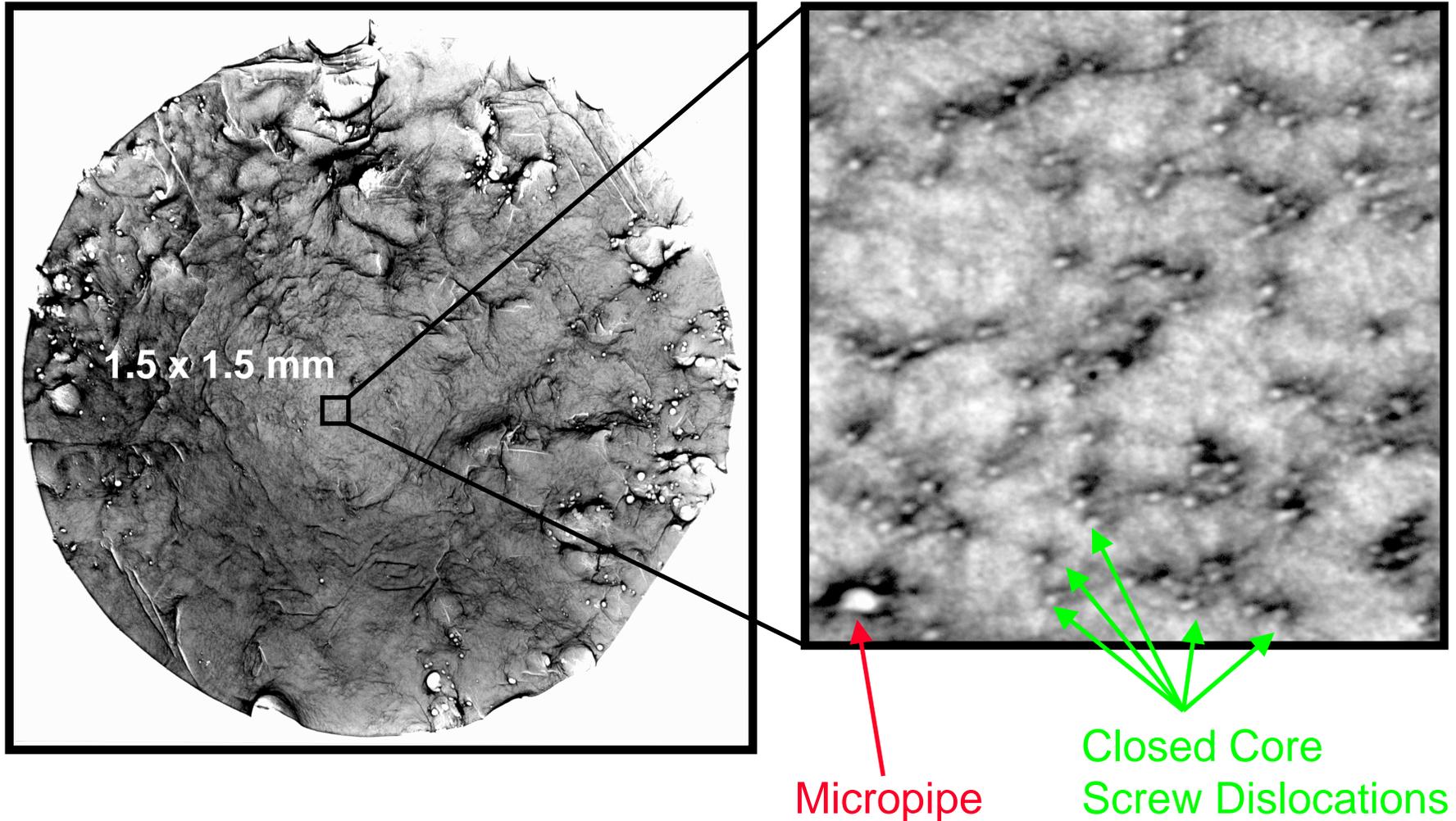


X-Ray Topograph



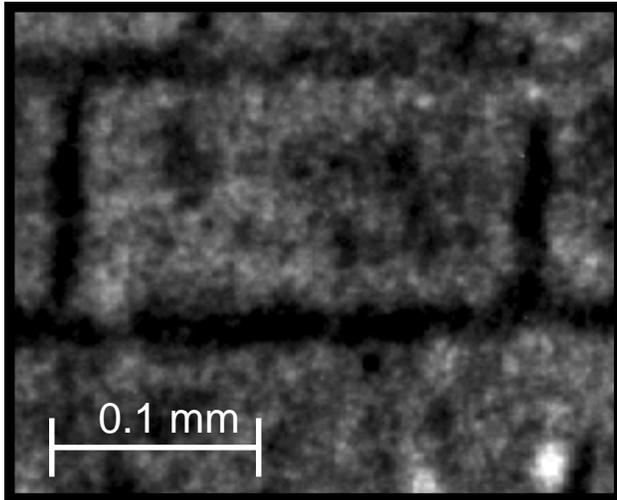
(Wafer purchased late 1997)

X-Ray Topograph of Cree "Low Micropipe" Grade 35 mm Wafer



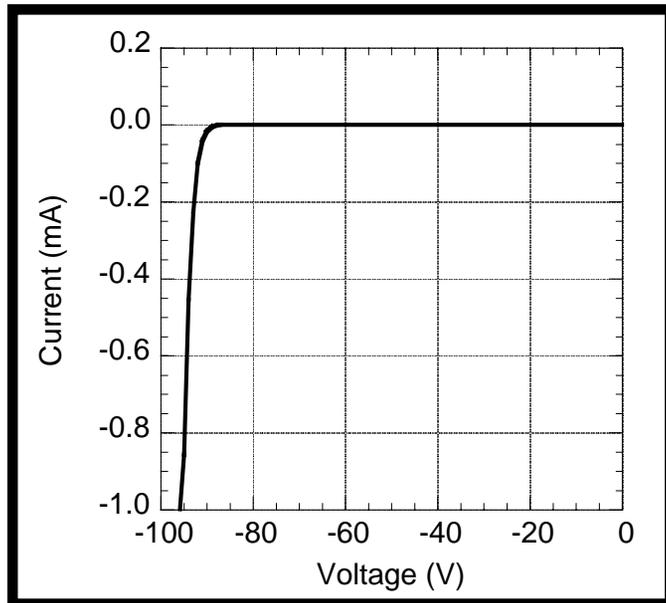
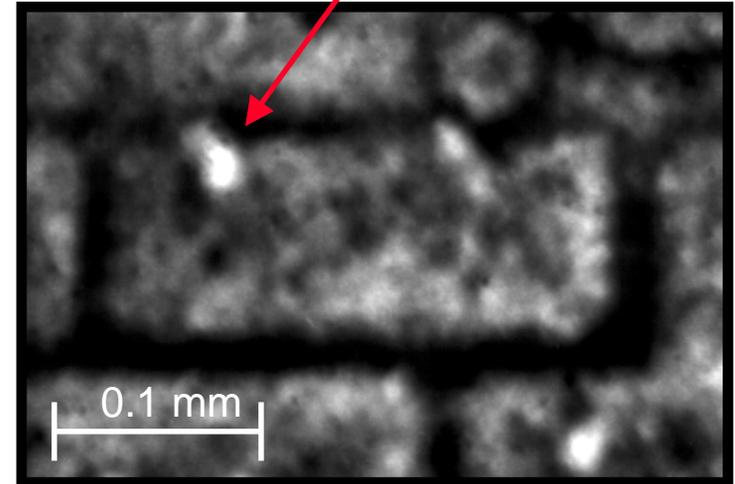
Micropipe Density \ll Total Defect Density

Diode without 1c screw dislocation

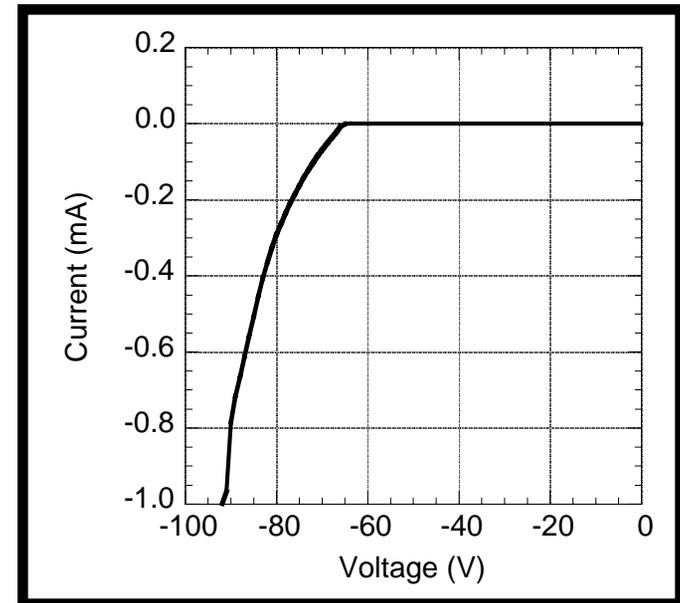


X-Ray
Topographic
Images of
Rectangular
Diodes on
Same Wafer.

Diode with 1c screw dislocation

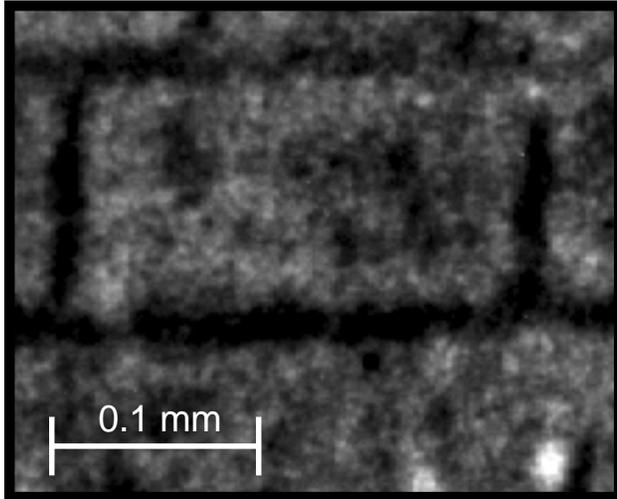


Reverse I-V
Characteristics
($T_A = 300\text{ K}$)



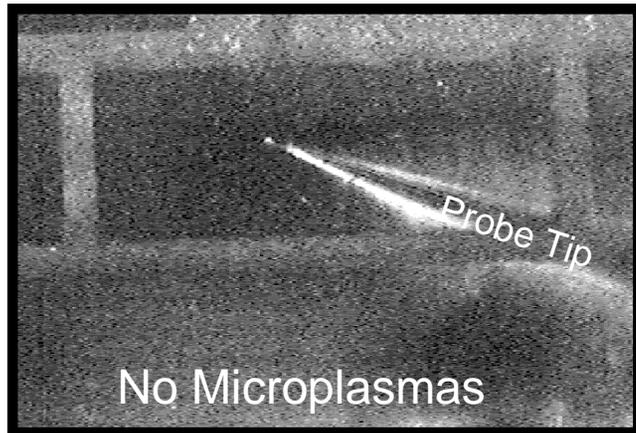
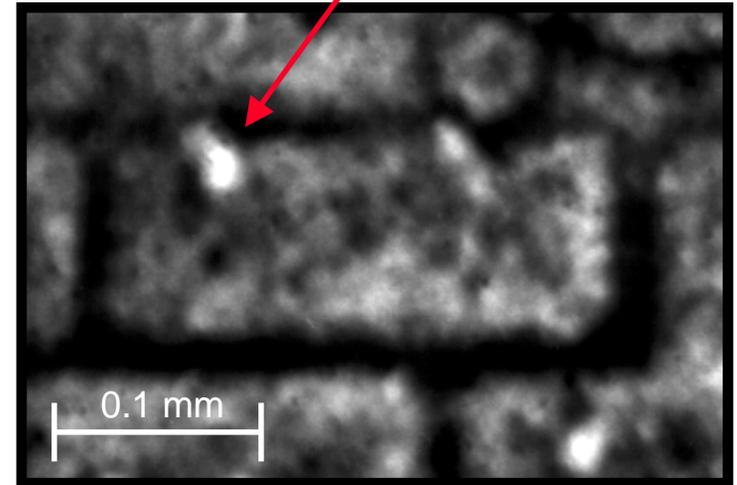
Breakdown Microplasma Corresponds to 1c Screw Dislocation

Diode without 1c screw dislocation



X-Ray
Topographic
Images of
Rectangular
Diodes on
Same Wafer.

Diode with 1c screw dislocation



Low-light Optical
Micrographs of
Breakdown-Bias
Luminescence

