

## Company Information

**University of South Florida**  
**Department of Electrical Engineering**

## Area of Expertise (related to the BAA)

- **Non-contact metrology of**
  - semiconductor substrates
  - dielectric films
- **In-line measurement of process results and material characteristics.**

## Previous Relevant Accomplishments

### Silicon IC Process Monitoring

- "Degradation of oxide properties caused by low-level metallic contamination," A.M. Hoff, et al., ECS Fall 2003.
- "Hydrogen-related mobile charge in the phosphosilicate glass-SiO<sub>2</sub>-Si structure, E. Oborina, et al., *J. Appl. Phys.*, 92, 6773, 2002.
- "Sequential COCOS and SPV Metrology and its Application to IC Process Monitoring," A.M. Hoff and D.K. DeBusk, ECS Fall 1999.
- "Fast non-contact diffusion-process monitoring," D. K. DeBusk and A. M. Hoff, Solid State Technology, No. 4, 1999.

### SiC Process Characteristics and Monitoring

- "Growth and Metrology of Silicon Oxides on Silicon Carbide," A.M. Hoff, MRS Spring 2004.
- "Non-contact Doping Profiling in Epitaxial SiC," A. Savtchouk, et al., Paper 496, ICSCRM 2003.
- "Thermal Oxidation of 4H-Silicon Carbide Using the Afterglow Method," A.M. Hoff, et al., Paper 429 ICSCRM 2003.
- "Afterglow Thermal Oxidation of Silicon Carbide," A.M. Hoff, et.al., MRS F, 2002.

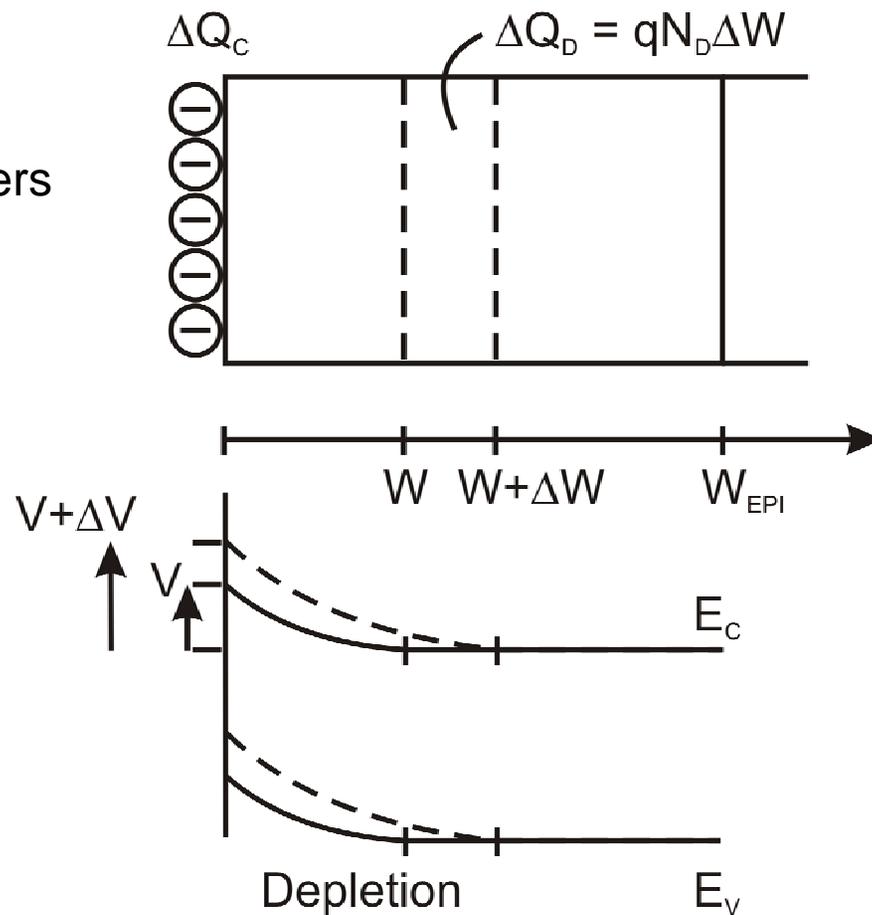
## Contact Information

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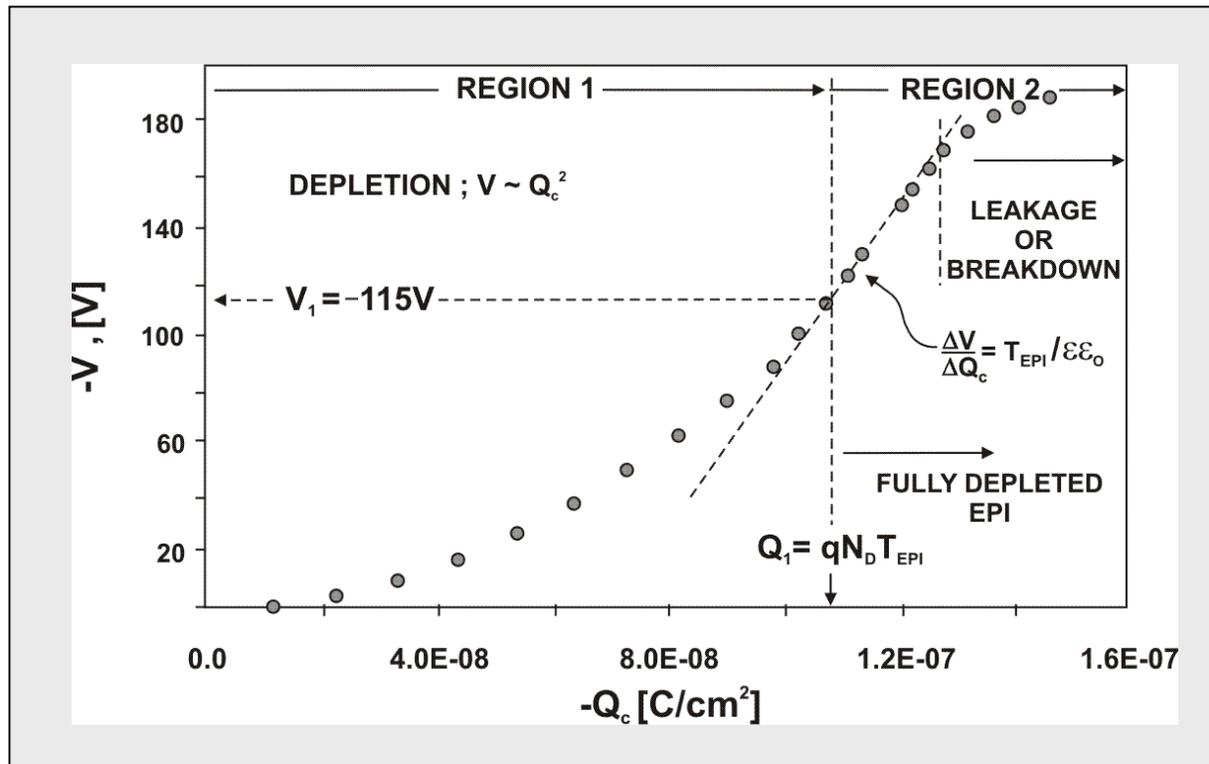
- ❖ Electric charge placed by a corona discharge source repels majority carriers and expands a depletion width by:

$$\Delta W = - \Delta Q_C / qN_D$$

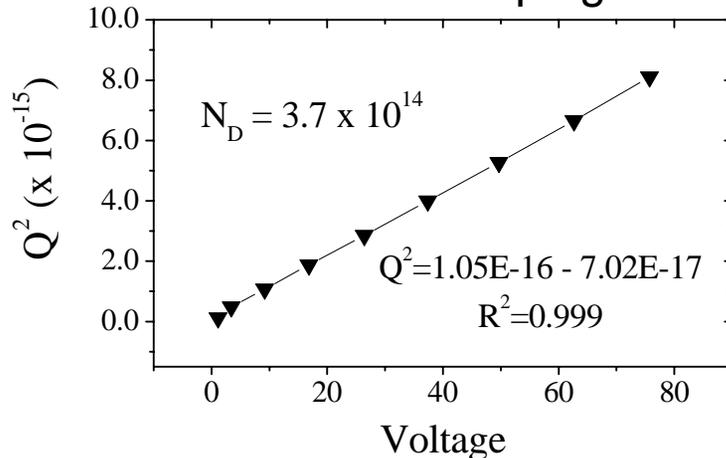
- ❖ The depletion barrier increases by  $\Delta V$  that is measured by positioning the charged site under the Kelvin Probe



- ❖ Series of Charging—Measuring Cycles Gives:  $V - Q$
- ❖ Doping  $N_D$  is Determined from:  $Q^2 = 2\epsilon_0\epsilon qN_D (V + V_0)$



**A:**  $Q^2 - V$  for Uniform Doping and Region 1



**B:** Doping Profiling, Regions 1 and 2

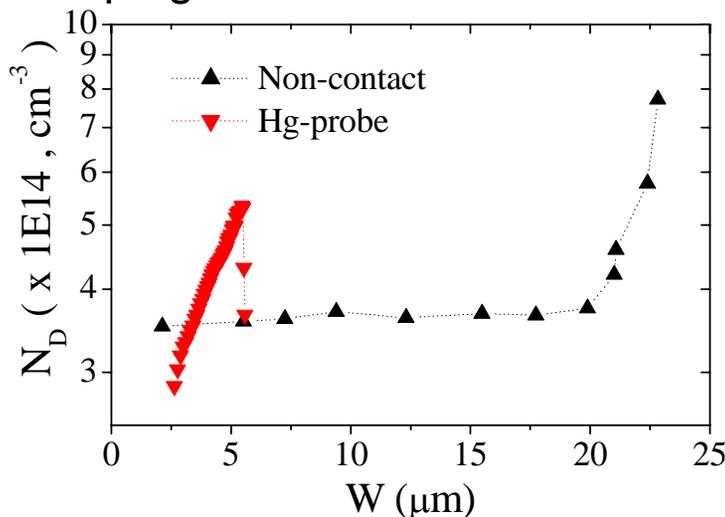
❖  $C(V)$  is Obtained by differentiation of  $V-Q$

❖ Doping Profile is Obtained as:

$$N_D(W) = Q^2 / 2q\epsilon\epsilon_0 V_D$$

where

$$W = ( 2 \epsilon\epsilon_0 V_D / qN_D )^{0.5}$$



❖ Voltage Maps of two different wafers following charging.

