Semiconductor-based Bio/Chem Sensor (Master's Research)

At the Centre for Nanoelectromechanical Systems (NEMS) and Nanophotonic (CNNP), IIT Madras, Aug 2013 - Mar 2017

Fabrication of pH-sensitive Electrolyte Insulator Semiconductor Capacitor (EISCAP) micro-sensor: Using conventional micro-fabrication techniques with Silicon Nitride (SiN) as the pH-sensitive layer as shown in Fig. 1.

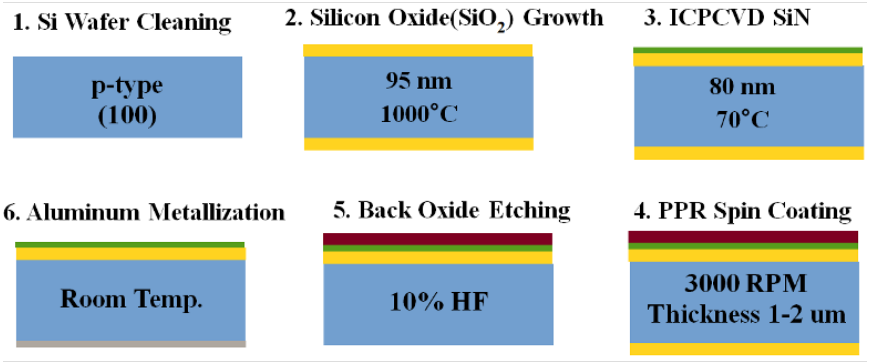

Figure 1: Fabrication process flow

Characterization (Capacitance-Voltage) and Calibration Curve (pH vs. the amount of $N-NH_3$):

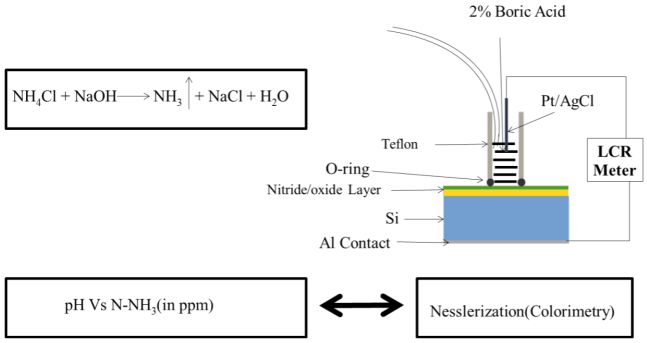

Figure 2: Methodology for a standard calibration curve (pH vs. the amount of $N-NH_3$).

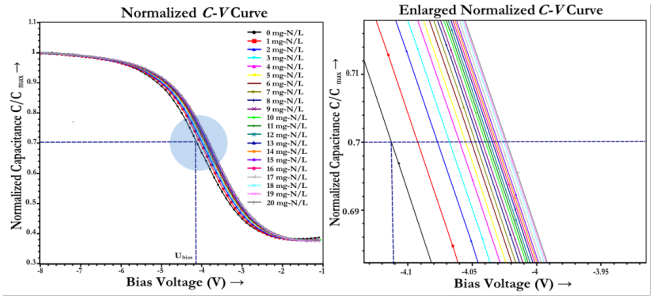

Figure 3: **On the left:** Normalized C-V curve for various concentrations from 0 mg-N/L to 20 mg-N/L; **On the right:** An enlarged view of the blue shaded region to show the exact shift in a C-V curve toward the right (as the amount of $N-NH_3$ increases, the C-V curve shifts toward right i.e. from acidic to basic pH).

Conclusion: Sensor range of 0-20 mg-N/ml and pH sensitivity of 55 mV/pH (mitigated the sensor drift issue)

Skills:

Wet Lab/Bench	Imaging and Instrument Techniques
Photomask Fabrication	Confocal Microscope (Olympus)
Photo-lithography	Surface Profiler (Bruker 3D)
E-beam Lithography	Scanning Electron Microscope (SEM)
Oxidation and Diffusion	Microscope Nikon Eclipse
Thin Film Deposition	LCR-Meter
Spin Coating	V-I Probe Measurement
Dry Etching	
Metallization	
Bonding	
Wafer Dicing	