Project Name: **Macroporous Silicon Sensors for Chemical & Biological Detection**

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Abstract:

The goal for phase 1 of this project was to advance the performance and integration of a relatively new class of silicon-based chemical and biological sensors that have demonstrated an electrical response to a variety of substances, and that can be used to monitor contaminants in air and water samples. The devices, which were fabricated at RIT, utilize flow-through silicon sensing membranes with deep trench structures formed to depths up to 100μm, fabricated by electrochemical etching which transforms the silicon into macro-porous silicon (MPS). The goal for phase 2 of this project was to improve the sensor response (sensitivity & selectivity) for a selective binding process based on the initial results from previous generation devices. The physical device structure was improved by using a pre-patterning mask to reduce surface roughness for better electrode contact and reducing oxide thickness for better signal-to-noise response.

The sensors have demonstrated the ability to detect the presence of certain chemical and biological materials, both in gas and liquid phases. The electrical responses that had shown the most sensitivity were AC conductance and capacitance. The sensors have also demonstrated the ability to discriminate between different solvents in liquid phase, and they have shown sensitivity to selective binding processes between biological materials including protein binding and DNA hybridization. In phase 2 of this project, similar signal waveforms were obtained, however the measured capacitance values were smaller than the previous version.