Synthesis and Characterization of Palladium nanoparticle doped 3D-Graphene Nanosheets supports for Fuel Cells

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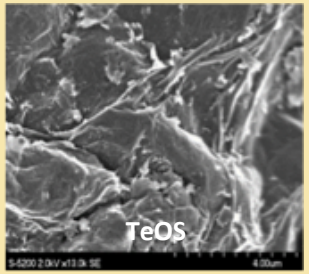
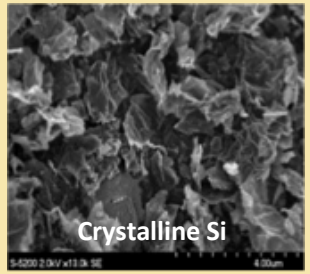
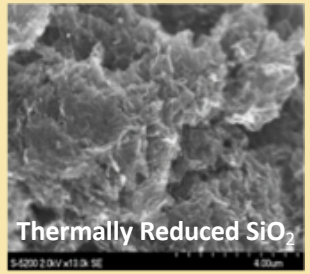
Problem: The depletion of fossil fuels along with the increasing demand for energy has given rise to the development of sustainable energy technologies like fuel cells. Fuel cells require catalysts in order to have the reaction move forward and catalysts require supports at both the cathode and anode of the fuel cell.

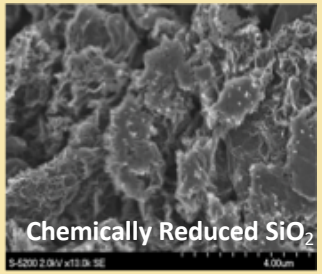
Goal: Synthesize 3D Graphene Nanosheets (GNS) and determine which kind (based on a set of 3 factors) is optimal using different characterization techniques. The factors looked are weight ratio of GNS:Si support, Si based support, and reduction method.

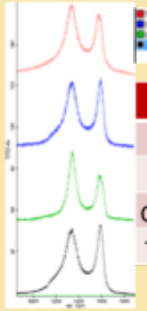
Results



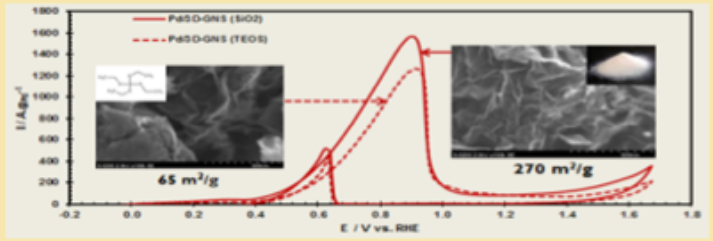




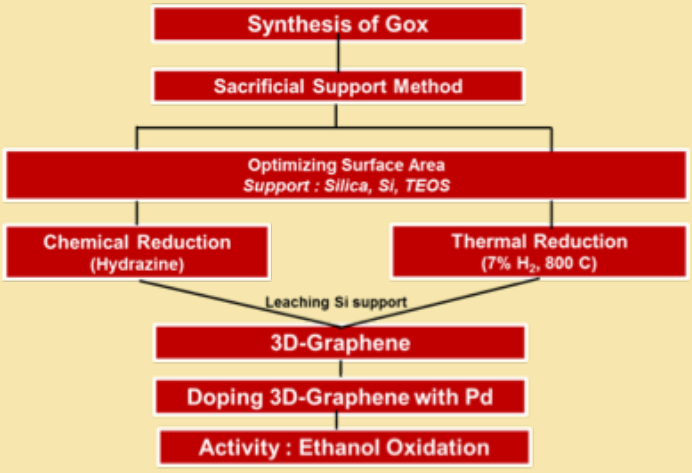




Name	D	G	D/G
TeOs	173.83	145.5	1.19
Si	22.77	24.7	0.92
Chemical	27.6	17.8	1.55
Thermal	46	48.6	0.95



Methods



Summary:

- Highest electrochemical surface area (ESCA) did not have higher electrochemical activity. (SiO_2 Chemically Reduced had ECSA of 313m^2 /g while thermally reduced SiO_2 had ECSA 270m^2 /g but thermally reduced had higher electrochemical activity.
- Modified Hummer's Method gave high quality Graphene Oxide
- Raman Spectra showed Chemically SiO_2 Reduced had most defects

Future Work:

- Test catalyst and support in a fuel cell
- Test Crystalline Si Support's electrochemical activity