Enhanced Specific capacitance and Rate Performance from RGO/ RuO_2 Hybrid Systems

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Outline

- Results of 2014 VFP
- This summer work (VFP 2015)

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Supercapacitors and Energy Storage

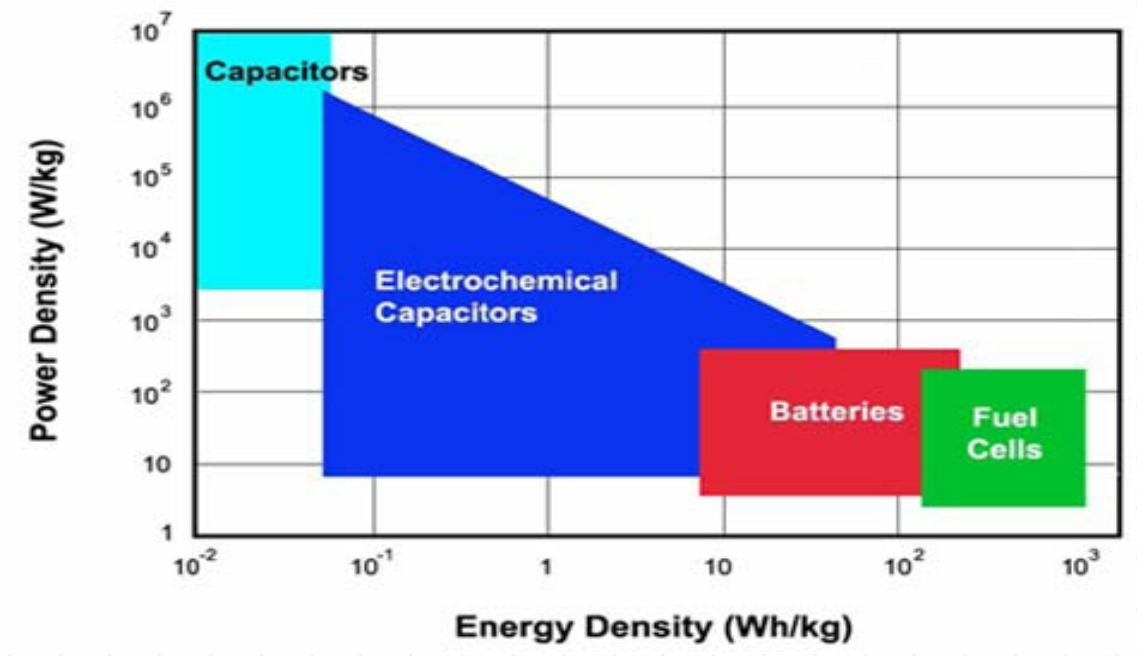
Hybrid bus with supercapacitors (Germany)

Paris T3 tram line (France)

Street light combining a solar cell power source with LED lamps and supercapacitors (Japan)

Mazda 6 (since 2010)

Specific energy and power capabilities



Specific energy and power capabilities of capacitors (electrostatic), electrochemical capacitors (supercapacitors), batteries and fuel cells (Kötz et al., 2000).

Battery- Supercapacitor

	Battery	Supercapacitor
Energy Density (Wh/kg)	100- 200	*5
Power Density (kW/kg)	1-3	10
Charge-Discharge	Slow	Fast

* Same as a regular battery but 40 times less weight than the battery

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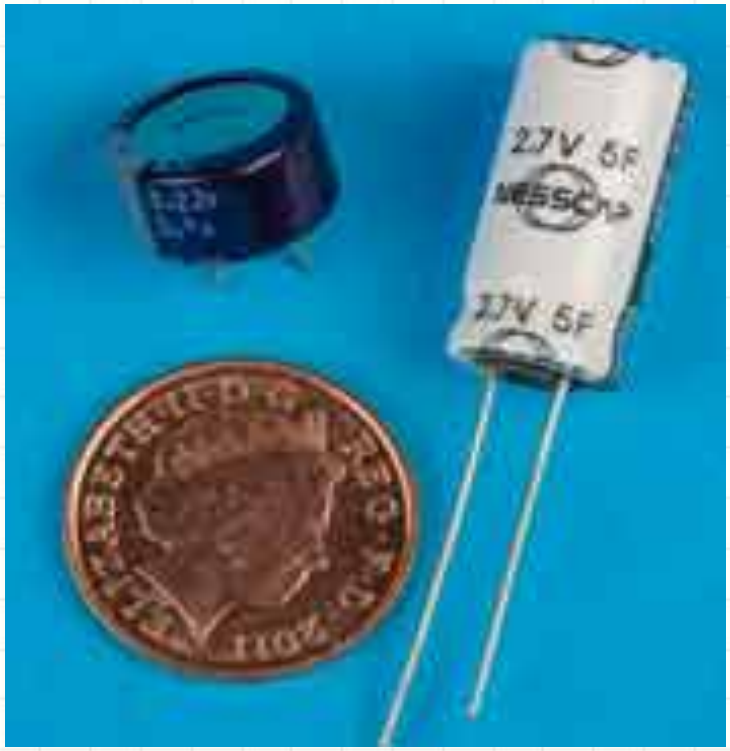
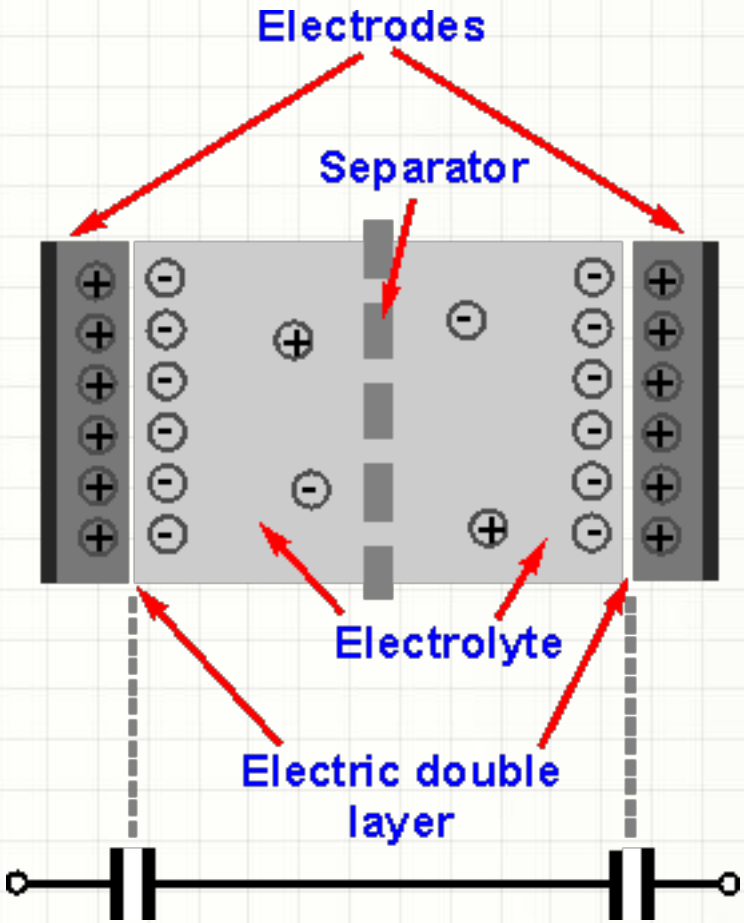
Supercapacitors





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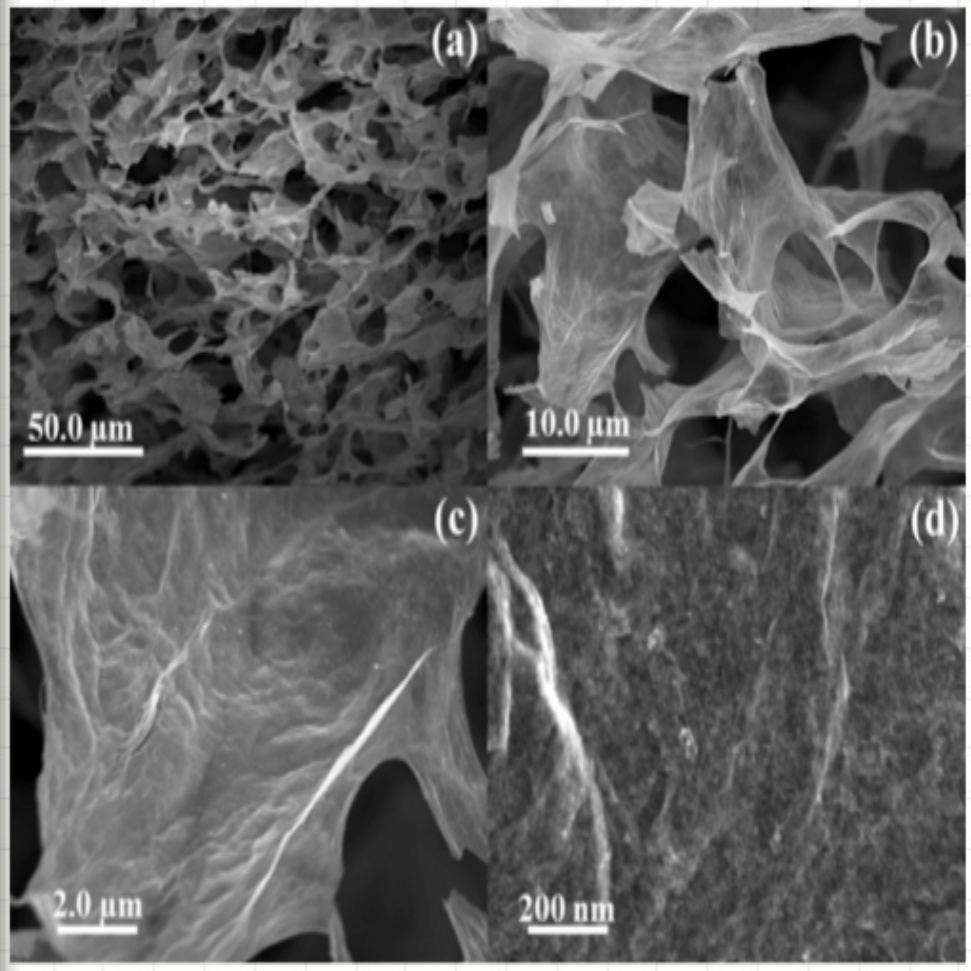
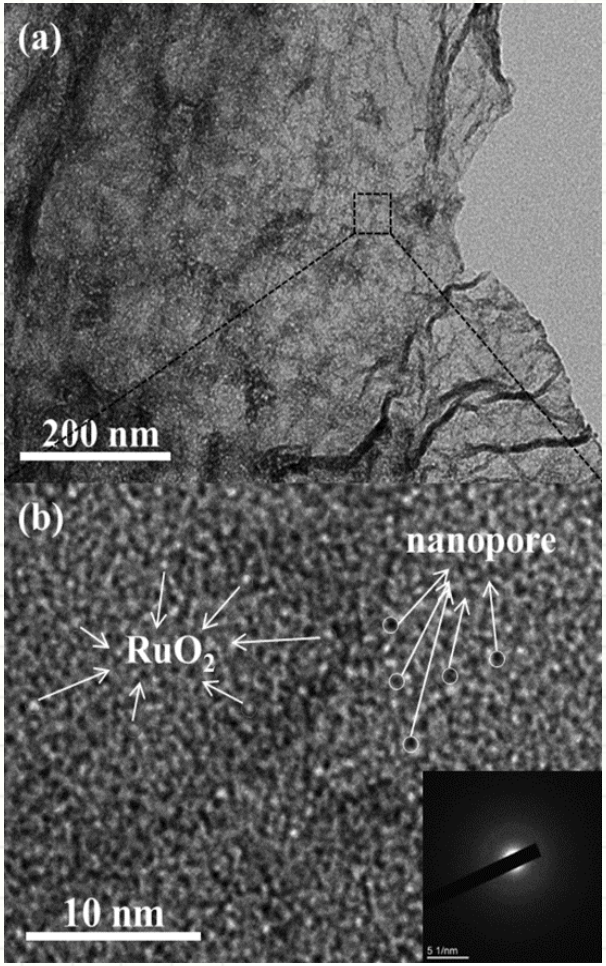
SEM and TEM of rGO-RuO_2





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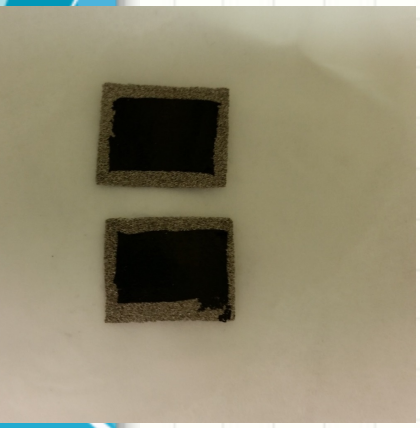
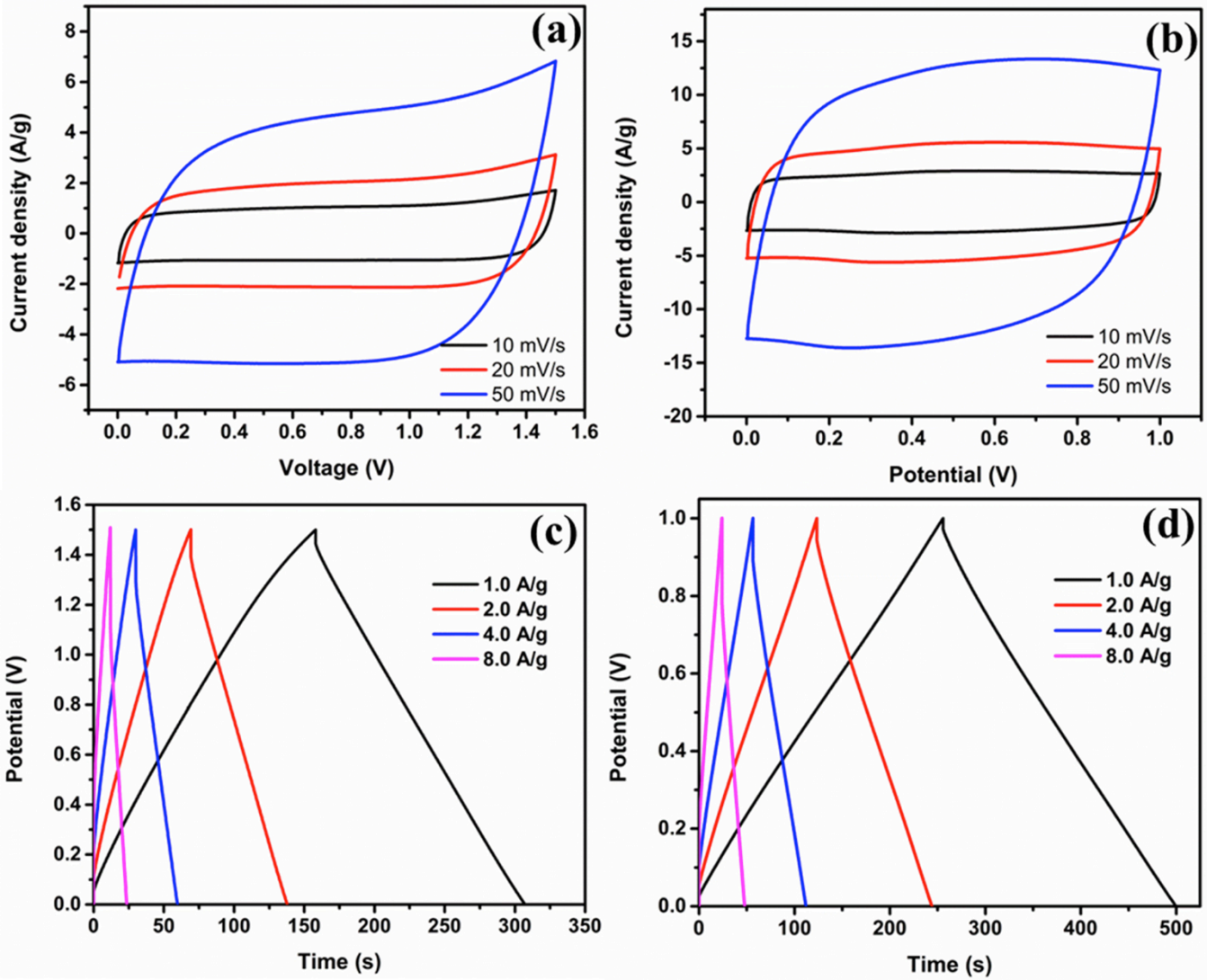
CV and charge-discharge of rGO-RuO_2 in Na_2SO_4 and H_2SO_4





C_p=509F/g in H_2SO_4
C_p=206.8F/g in Na_2SO_4

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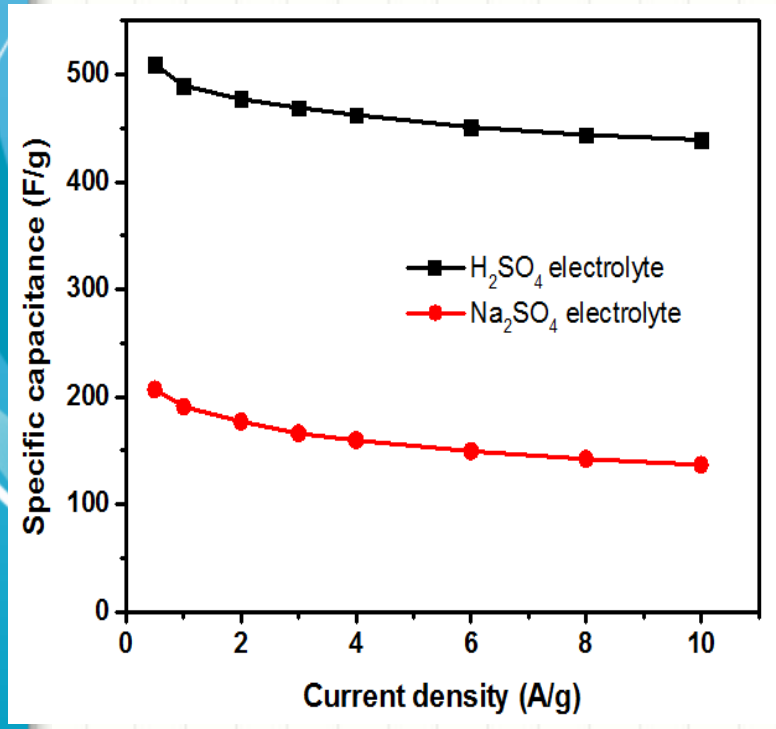
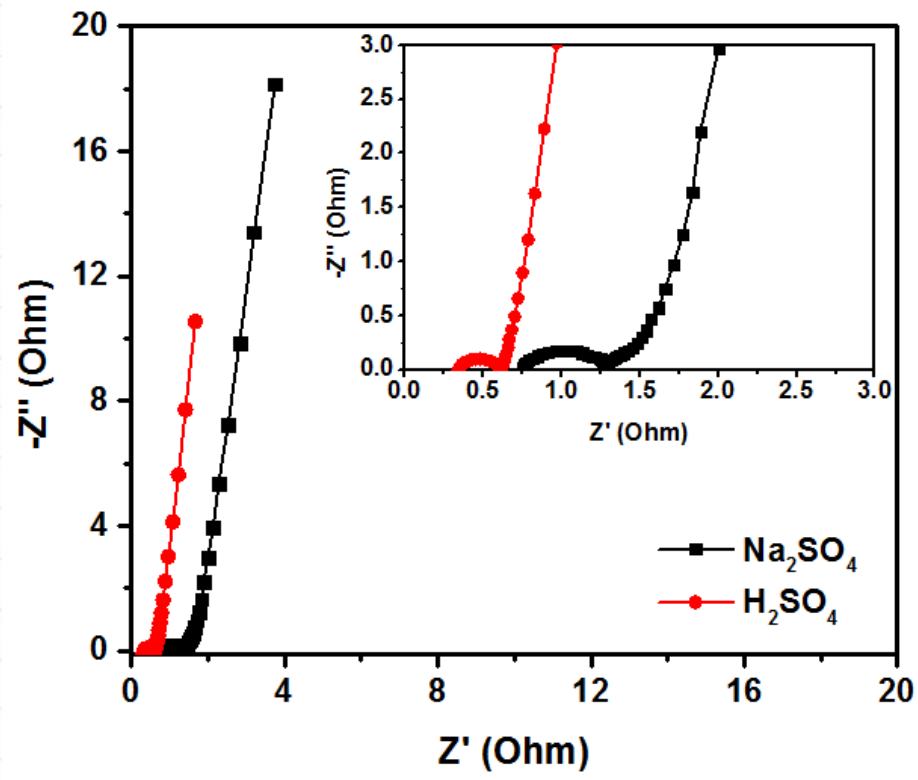
Electrochemical Impedance spectra (EIS) of rGO-RuO_2





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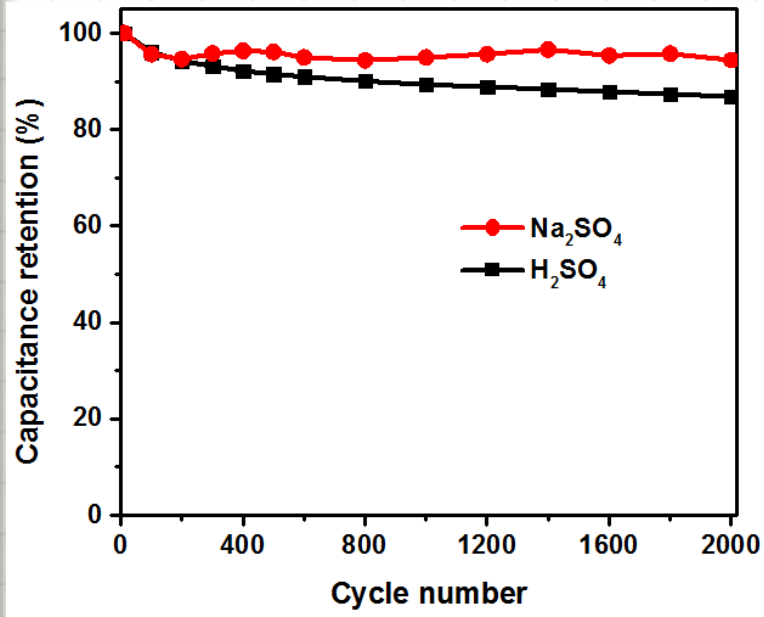
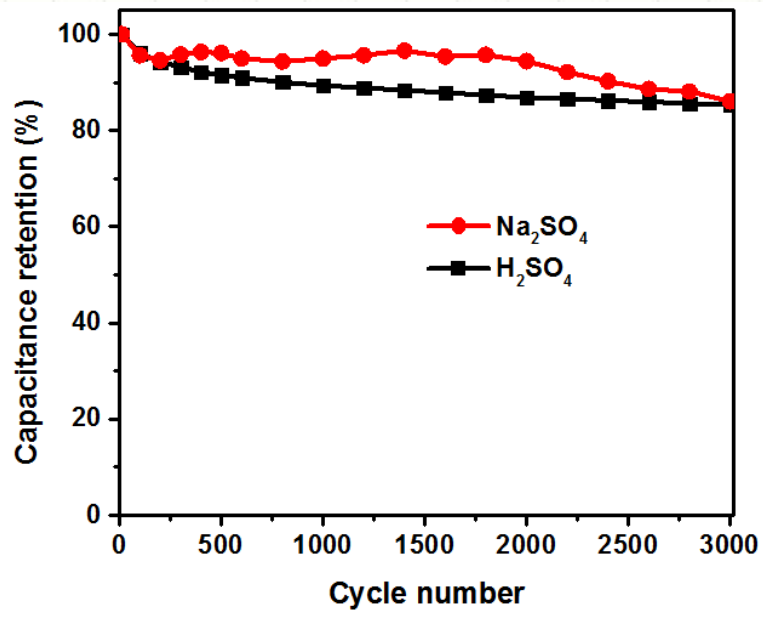
Cycling stability of rGO-RuO_2





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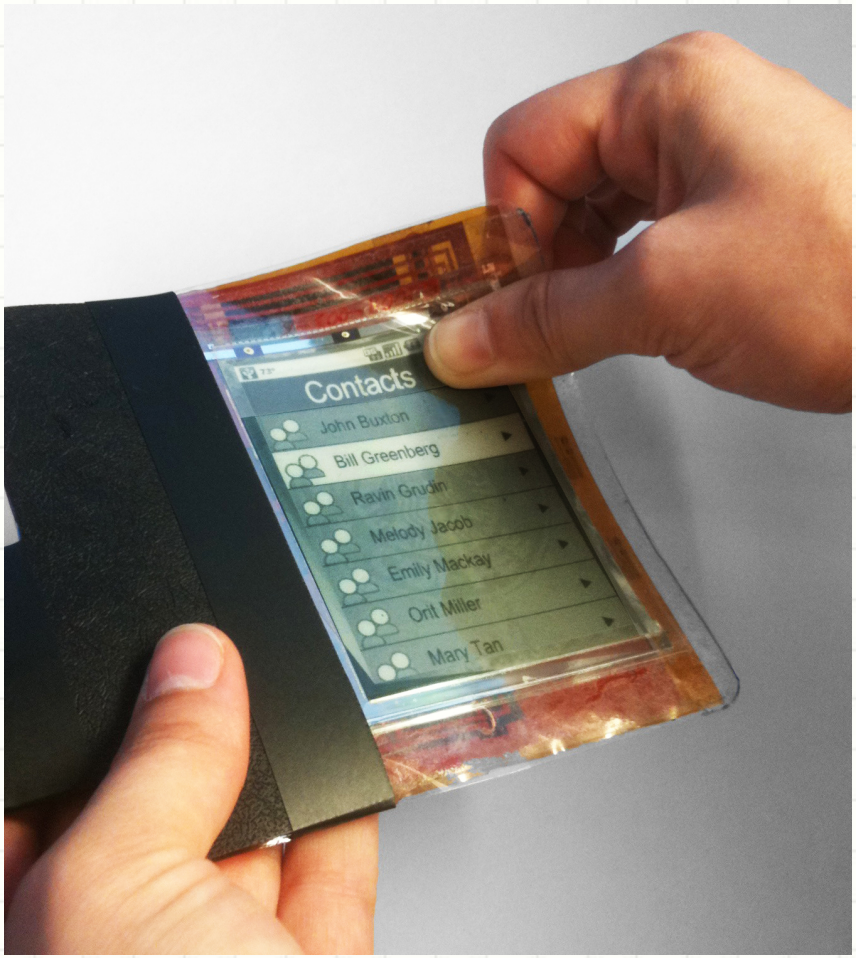
Flexible devices



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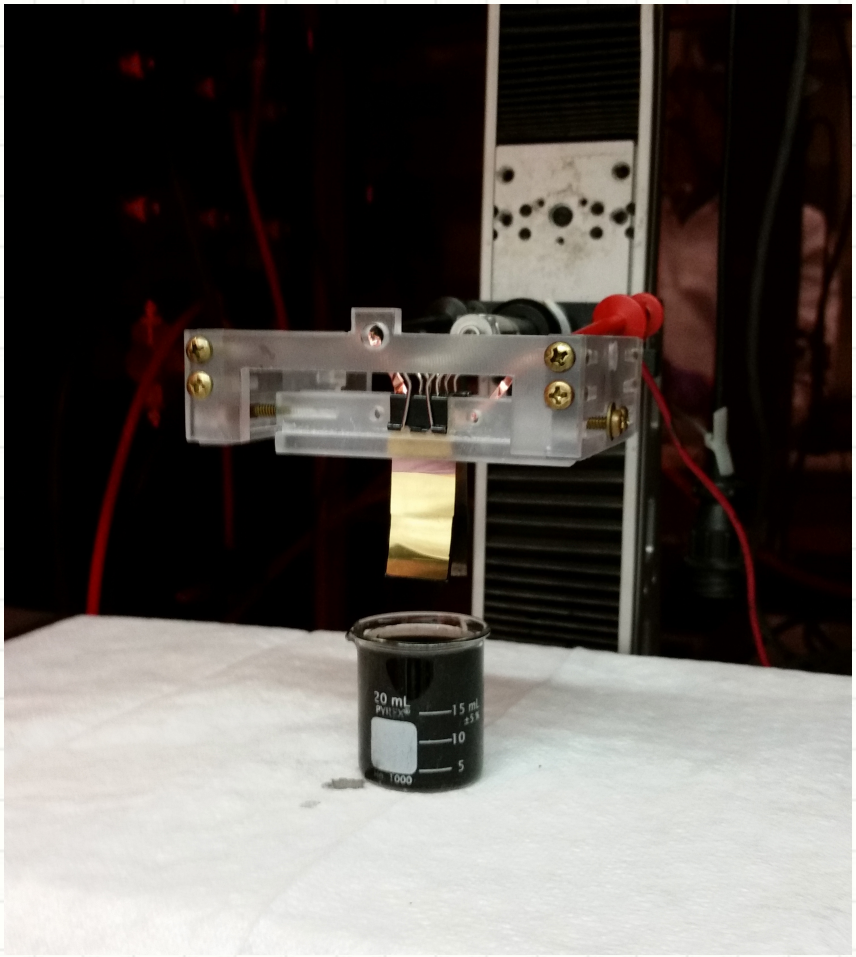
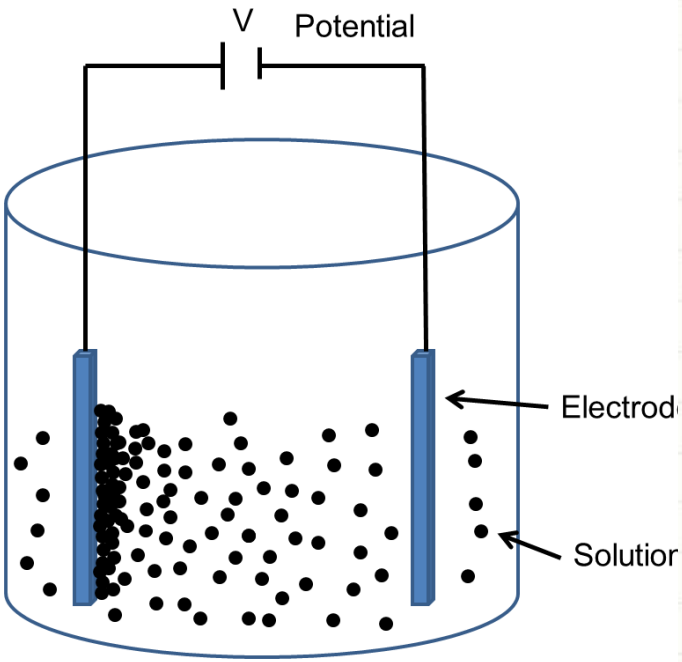
Electrophoretic deposition





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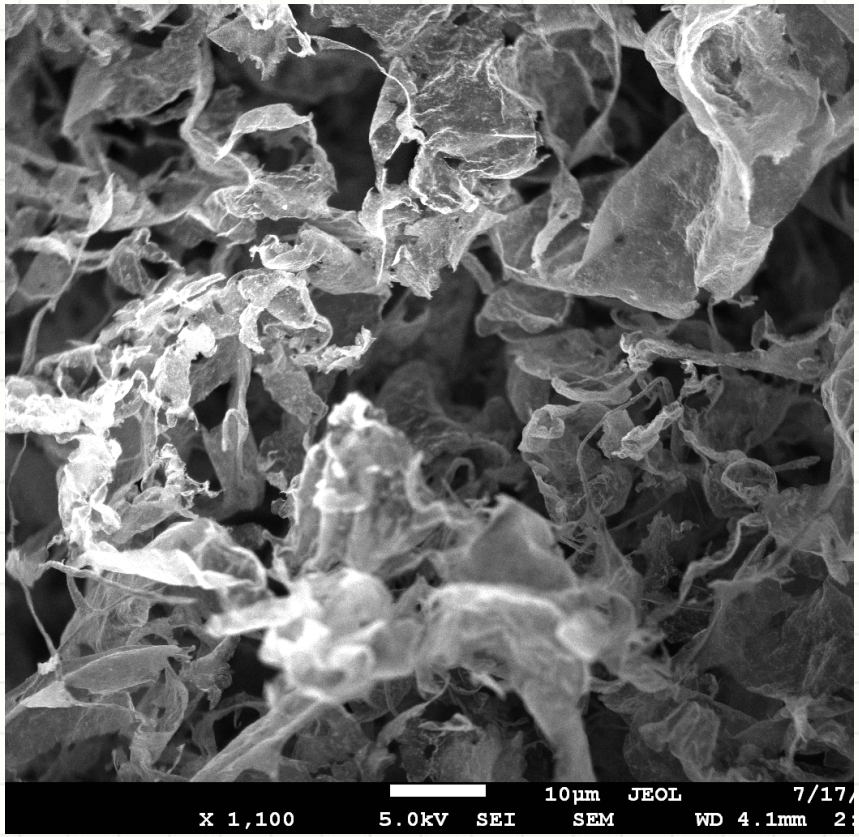
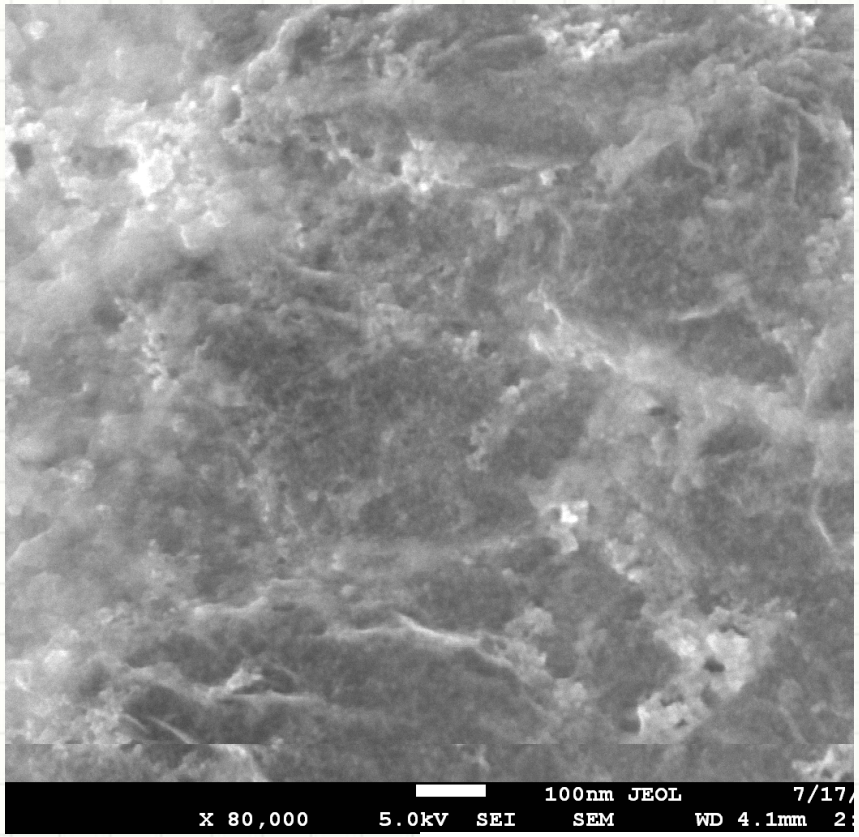
SEM pictures





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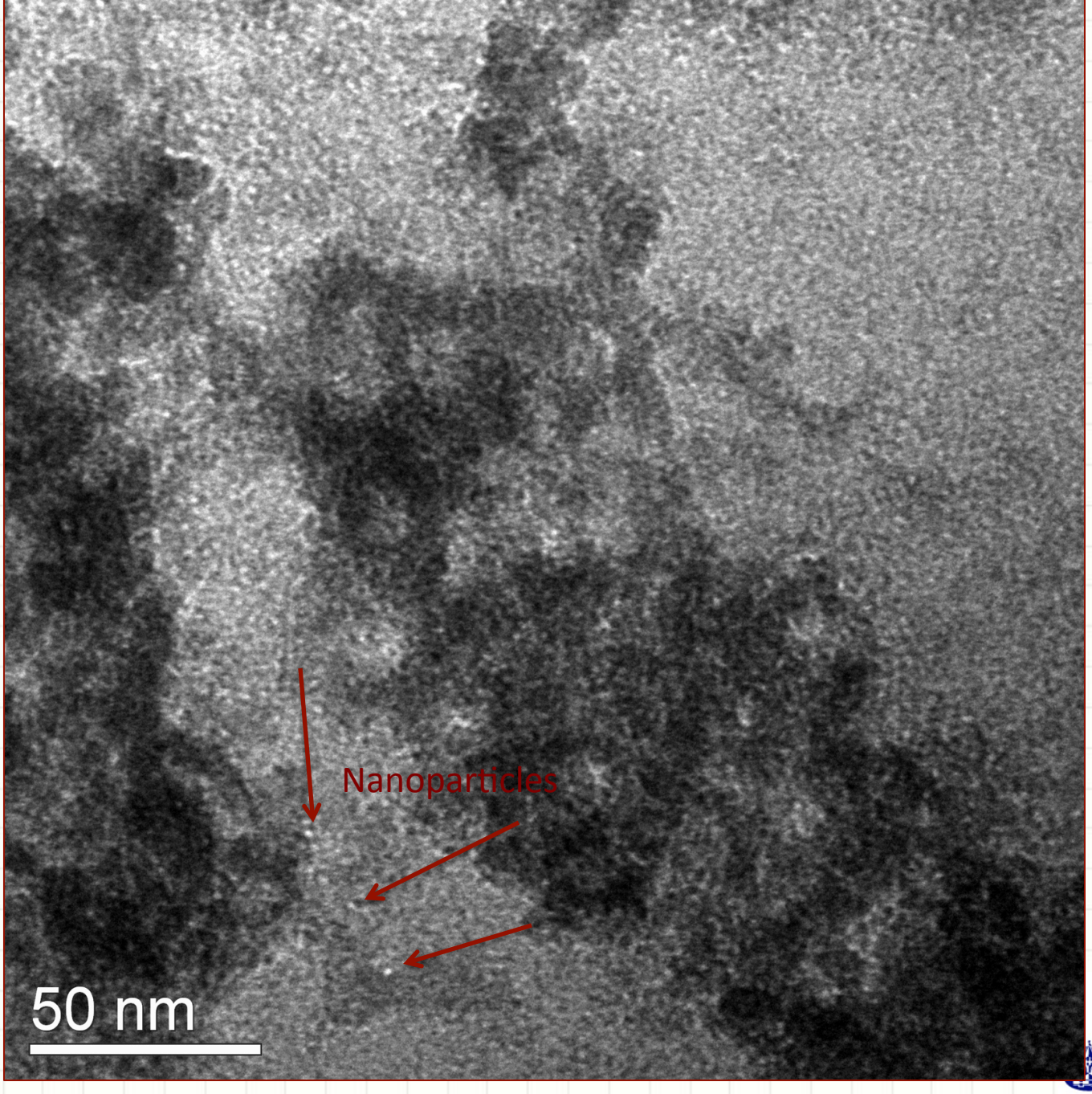

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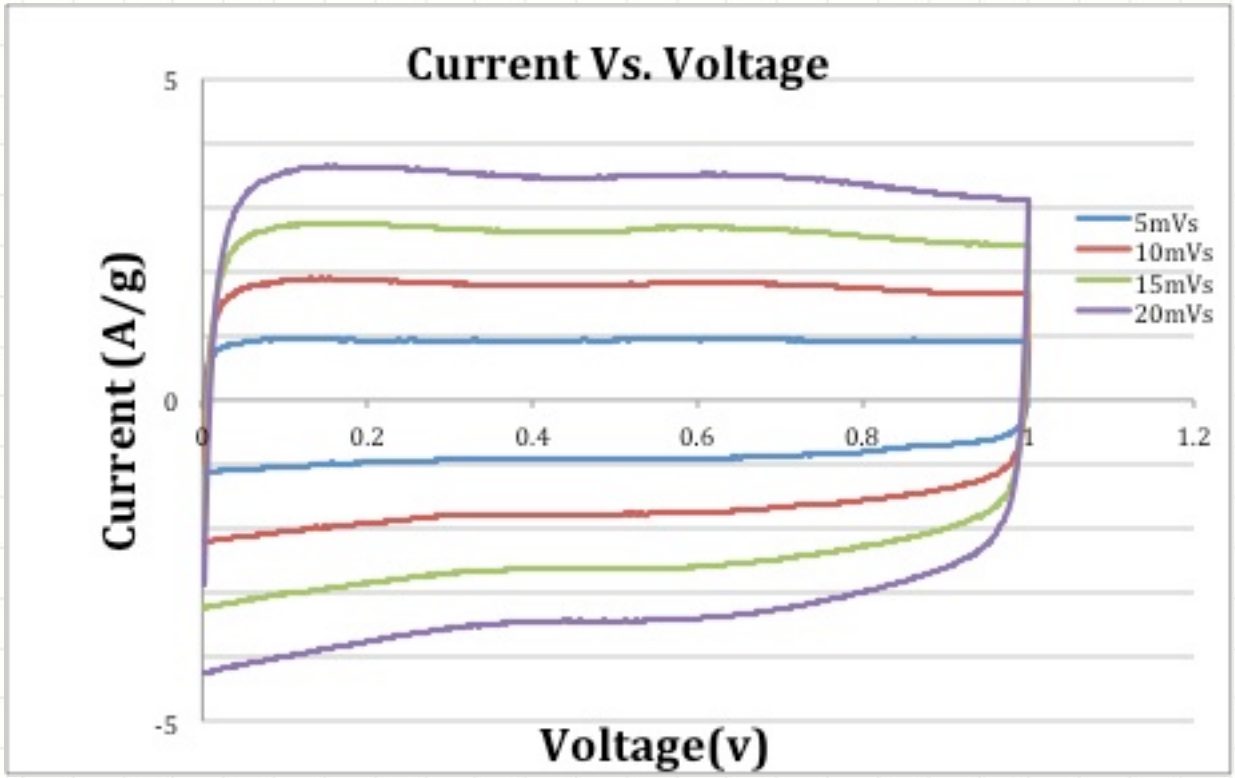
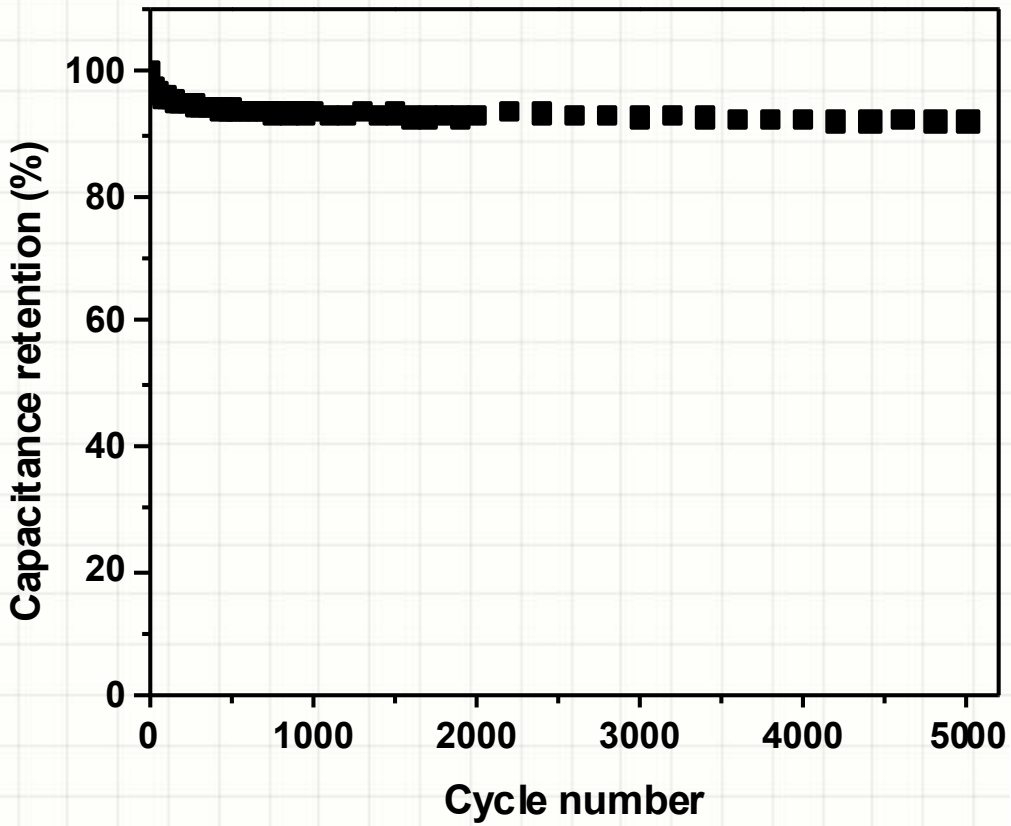
CV data

C=368 F/g



Capacitance retention



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Aknowledgements

- VFP-DOE
- Noel Blackburn
- Cindi Biancarosa
- Dmytro Nykypanchuck
- Viet Hung Pham
- James Dickerson

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QUESTIONS?

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