Fabricating and Testing 100 F Electrochemical Capacitors: Case Electrochemical Capacitor Fabrication Facility (CECFF)

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## **OBJECTIVES AND APPROACH OF THIS PROJECT**

#### **OBJECTIVES**

- Develop the capability to fabricate sealed capacitor cells using standard industry approaches
- Fabricate capacitors with new materials and evaluate performance
- Explore composition effects on performance
- Make facility available to industry and universities to advance new materials development

#### APPROACH

- Materials are evaluated in nominal 100-F size, spiral-wound sealed packages, which is a popular commercial mid-size product
- Carbon electrode materials, electrolyte, separator, additives and package seal materials can be evaluated using these sealed cells

# **Fabrication Lab Flow Diagram**



# Fabrication Lab: slurry prep —> bobbin winding





## Fabrication Lab: bobbin drying –>final assembly



Complete bobbins in carousel







Carousel of bobbins in vacuum for drying



Initial testing

### PERFORMANCE OF 22450 CELL FORMAT PRODUCT OF CECFF CAN BE COMPARED TO MID-SIZE COMMERCIAL PRODUCTS



#### EXAMPLES OF INITIAL ELECTROCHEMICAL PERFORMANCE MEASUREMENTS

Capacitance Measurements @ 3A						
Run#	n	C <i>avg</i> farads	S.D			
2	4	44.0	1.65			
4	4	51.3	.43			
5	8	33.1	1.34			



		Experime			
	Run	Carbon			Activated
	Order	Black (wt%)	CMC (wt%)	Binder (wt%)	Carbon (wt%)
	1	2.0	1.8	1.0	95.2
	2	8.50	1.3	3.0	87.2
	3	8.50	1.8	5.0	84.7
L	4	2.00	0.8	5.0	92.2
Ľ	5	2.00	0.8	1.0	96.2
	6	8.50	1.3	3.0	87.2
	7	8.50	1.8	1.0	88.7
	8	2.00	1.8	5.0	91.2
	9	8.50	0.8	1.0	89.7
	10	8.50	0.8	5.0	85.7
	11	8.50	1.3	3.0	87.2
	12	2.00	1.8	5.0	91.2

- Capacitance measurements on multiple samples demonstrate reproducibility
- Impedance measurements show low ESR
- Leakage current measurements
  ~1.57 mA +/- .25 @ 2V after 1 hour

# FUTURE WORK AND COLLABORATIONS

- Experimental design experiments to further explore fabrication and composition parameters
- Aging studies to explore degradation factors and rates
- Cell designs and experiments to explore degradation mechanisms
- Collaborate with colleagues to test new promising materials using a sealed design
- Partner with industry and universities to help advance and commercialize new electrochemical capacitor materials



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