Thin Supercapacitors by Screen Printing Approach

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• PBC Tech has developed thin, flexible supercapacitors for energy storage/power applications.

• A brief approach is described herein.
Basic Supercapacitor GEN1 Prototype Device

• Size: 45X55X0.450, mm

• Cap = 0.225 Min.

• ESR = 80 mΩ Max.

• Operating Temp. -30 to 70 C.

• This size is chosen to establish basic technology.
Battery life is a key industry pain point in the fast growing connected devices market.

Peak power pulses degrade battery capacity and run-time
Manufacturers do not seem to have too many choices – throttle peak performance or use a larger battery.

Peak power pulses degrade battery capacity and run-time.
Supercapacitors complement batteries for peak power.
However, today’s products are too bulky to fit small form factors and traditional capacitors have 1/100 energy compared to supercapacitors.
• Using above technology many shapes and sizes can be made.
Printing And Manufacturability

- To make these various shape and size devices and designing for manufacturability, we have chosen screen printing method for electrode making.

- Industry standard is coating with slot die.
Advantages With Screen Printing

• Control over basic thickness and thickness control is possible. ( +/- 0.5 μ variation in thickness), thickness can be varied from 5 μ to 35 μ.

• Coating does not have to be removed from printed foil to make seals.

• This method can be used to make products from few hundred to millions.

• Relatively quick and less capital intensive method.
Printed electrode sheet- pre cut
electrodes are printed 42 to a sheet, then cut all at once using a die into desired shape, 5mm bare aluminum border surrounding electrode with 8mm tab extending from one edge.
Assembly Process

Components of assembled cell
- Electrode x2
- Sealant sheet x 3
- Separator

Components are stacked on top of one another between two metal dies as follows: electrode-> 2x sealant sheet-> separator-> 1x sealant sheet-> electrode and placed in a heated press to bond all layers together.
• Electrodes are made by printing carbon based inks on current collectors.

• Current collectors are Al foil.
Electrode Ink Development

• Water-based conducting inks were developed in-house.
  ➢ Water-based, and environmentally friendly.
  ➢ Rheology can be tailored
  ➢ Device properties can be manipulated by adjusting ink components.

Material properties are comparable to or better than existing devices.
Advantages of Screen printing Approach

• Easily scalable
• Low capital cost, no costly tooling changes
• Low wastage.
• Shapes and sizes of devices can vary easily.
• Low manufacturing cost and better from quality perspective.

• Using above approach devices are made and currently under reliability testing.