

Scaling of New Battery Technologies using the Battery Prototyping Center at RIT

RIT Battery Prototyping Center

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Facility Overview

Meeting Space



Slurry Mixing and Coating



Pouch and Cylindrical Cell



- RIT BPC works with universities, start-up companies, material and cell manufacturers to prototype and test battery materials
- Work can be done at an hourly pay-for-service rate or the BPC can partner on research through grant collaborations.
- Open user facility with strict IP protection
- 1000 sq. ft. dry room at <0.5% RH
- Semi-automated pouch and cylindrical cell fabrication equipment
- Custom electrode formulation and coating services
- Roll to roll coating & cylindrical cell line available now

Dry Room Environment

- ~1000 sq. ft. dry room
- Split Room Design
- Occupancy up to 6 people
- < 0.5% relative humidity
- -40°C dew point on return



Mixing and Milling Equipment

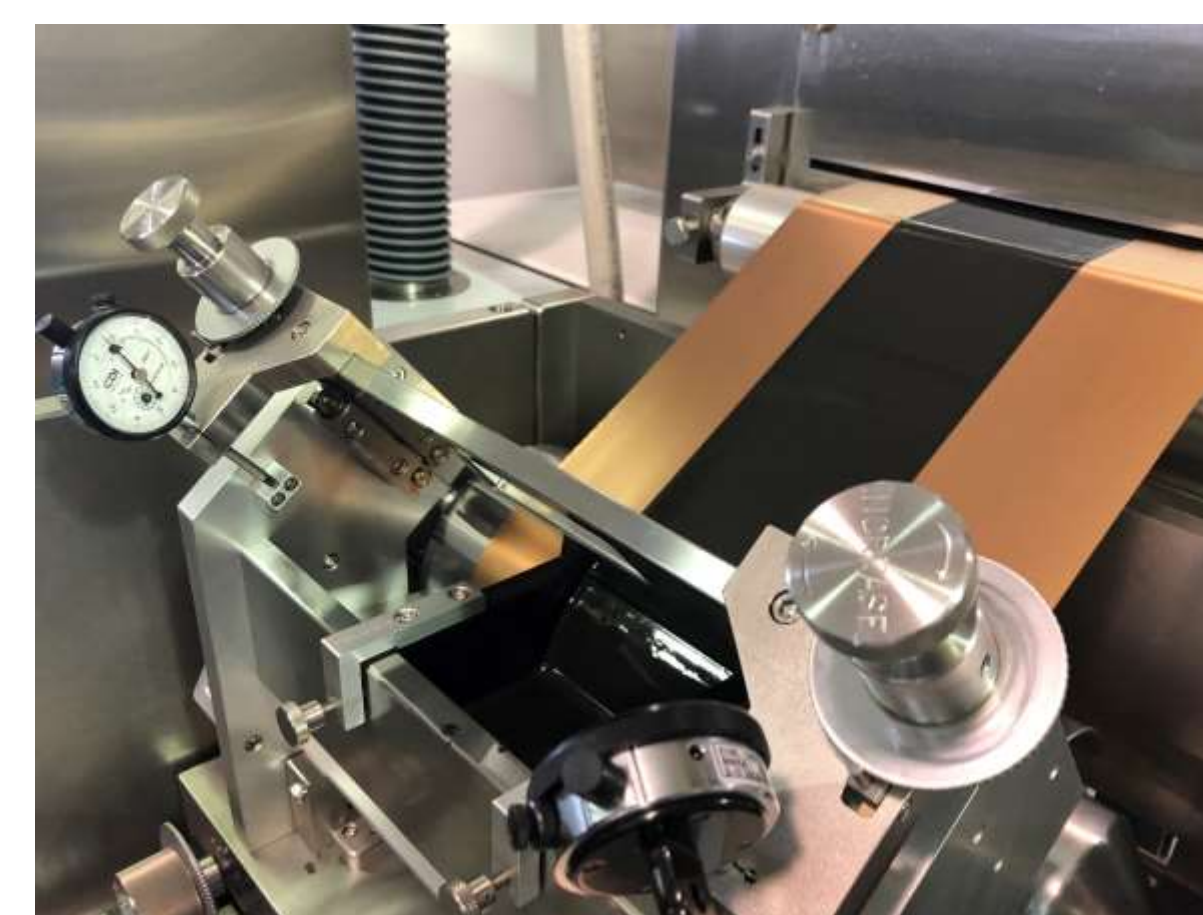


- Small volume to multiple liter slurry mixing
- Flacktek DAC100 – 100g planetary centrifugal bladeless mixer for small volume mixing
- Primix 1L planetary mixer has temperature control and vacuum to uniformly mix slurries
- Filmix high speed thin-film mixer can run in batch (50-90 mL) or continuous mode to homogenize slurry before coating
- Buhler laboratory bead mill can wet mill materials to the nano-scale

Abstract and Background

The Battery Prototyping Center (BPC) at Rochester Institute of Technology (RIT) has been developing pouch cells for universities and companies with novel battery designs for the last 4 years. During that time, the BPC has developed traditional battery formulations as well incorporated new materials of interest such as solid electrolytes and lithium metal anodes. The BPC features a 1000 sq. ft. dry room and an automated pouch cell line that can produce z-fold stacked cells from a few layers up to sixty or more stacked electrodes for performance demonstration. The equipment also has a large flexibility in cell size ranging from the current 34mm x 50mm size up to electric vehicle size cells (250mm x 250mm) to allow for future cell size considerations. The BPC was recently awarded expansion funding from Empire State Development and NY-BEST to enhance the center's capabilities. The new equipment allows for small to intermediate volume roll-to-roll coating and cylindrical cell fabrication. The expansion will enable mixing of up to 1L batches of slurry, slot-die and knife-over roll coating techniques, and roll-to-roll calendaring and slitting. The cylindrical line will have the capability to produce all the common form factors such as 18650, 2170, and 26650. An overview of the new equipment will be presented along with ways to utilize and work with the BPC.

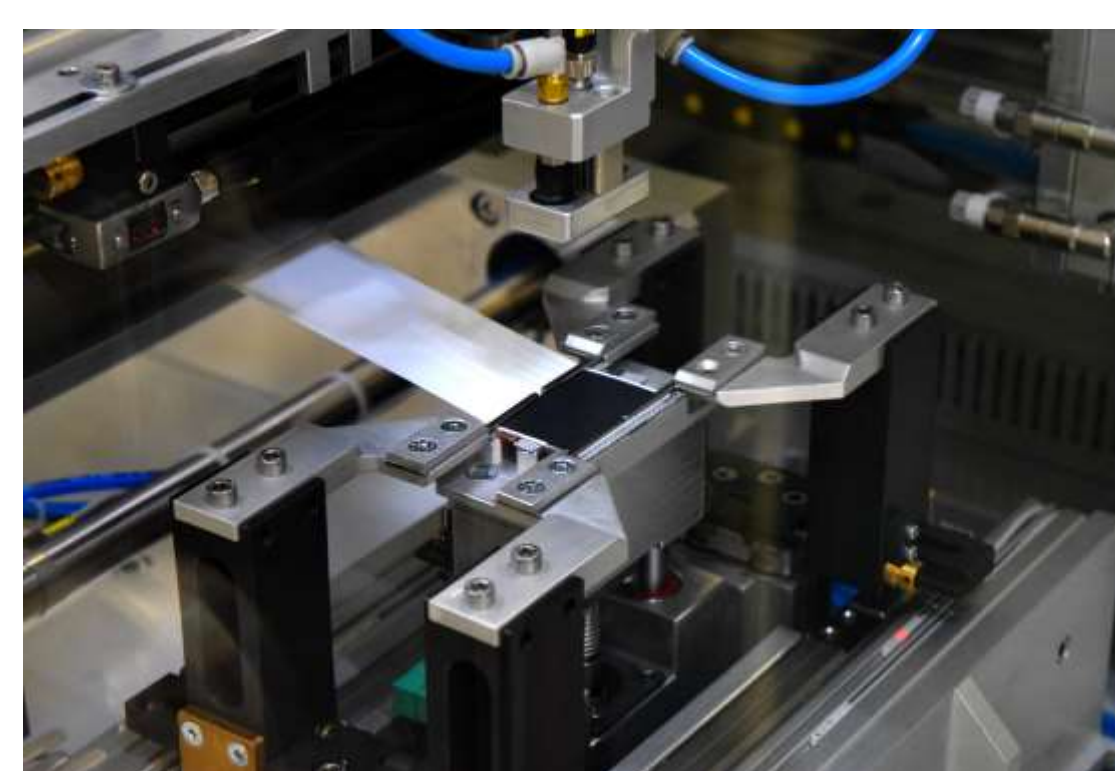
Roll-to-Roll Coating and Slitting



- Slot-die or knife over roll coating up to 330 mm web width
- 1L displacement tube slurry dispensing
- Edge alignment guide for accurate double sided-coating and rewind
- Forced-air floatation oven for drying
- Integrated slitting unit with two differential rewinds to slit cylindrical cell electrodes and custom widths

Pouch Cell Prototyping-Pilot Equipment

- Electrode Punching
- Z/Z Pick and Place Stacking
- Ultrasonic Welding
- Pouch Forming
- Top and Side Pouch Sealing
- Electrolyte Filling
- Degassing & Vacuum Sealing



34 x 50 mm up to 250 x 250 mm Cell Sizes

Cylindrical Cell Prototyping-Pilot Equipment



- Electrode winding
- Ultrasonic tab welding to strip
- Resistance welding of negative contact
- Ultrasonic welding of positive contact to cap
- Grooving machine
- Vacuum electrolyte filler
- Crimping machine



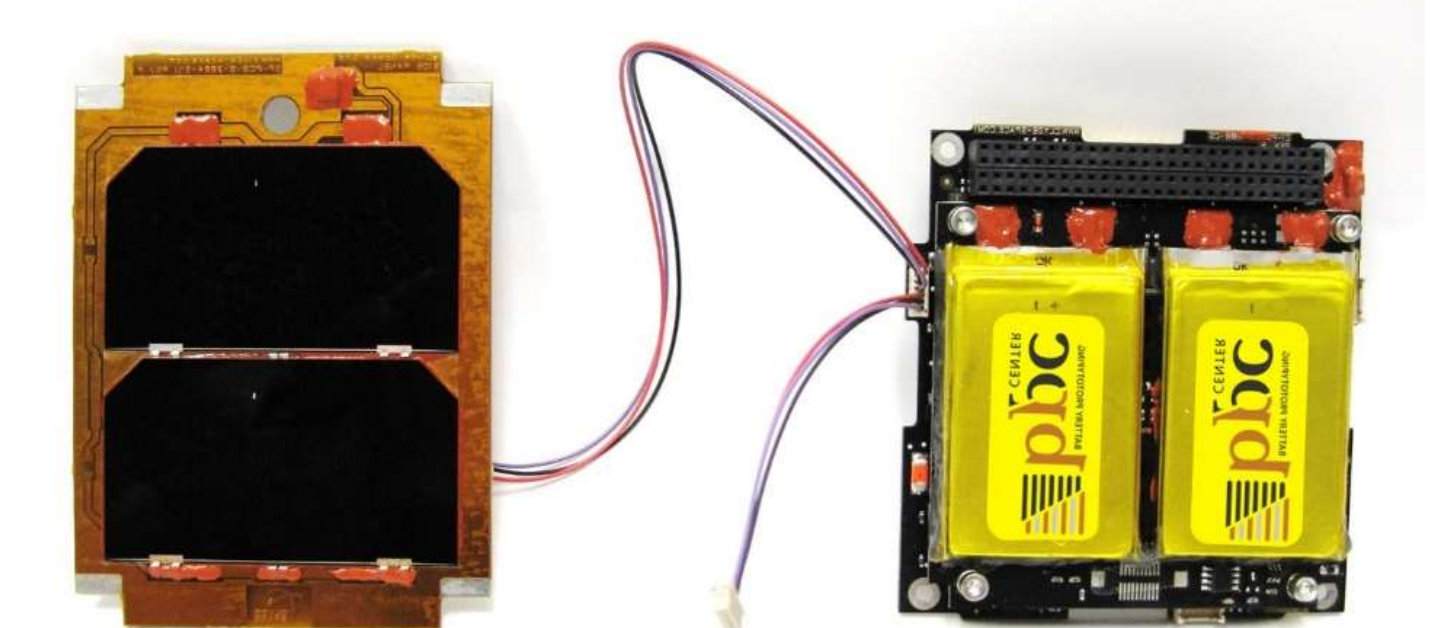
18650, 21700, and 26650 Cell Sizes

Formation, Performance, and Thermal Testing

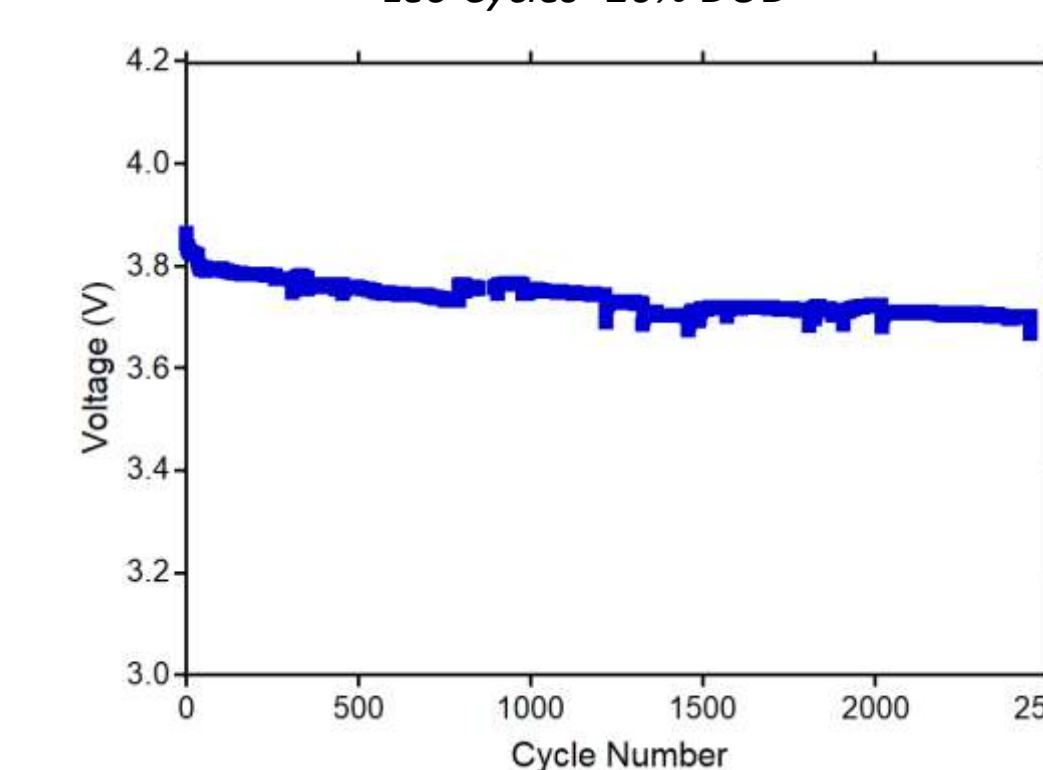


- 144 channels for formation and performance testing of coin, pouch and cylindrical cells
- Thermal and Thermal shock chambers for temperature testing from -40°C to 80°C
- HIPOT and Impedance Analysis

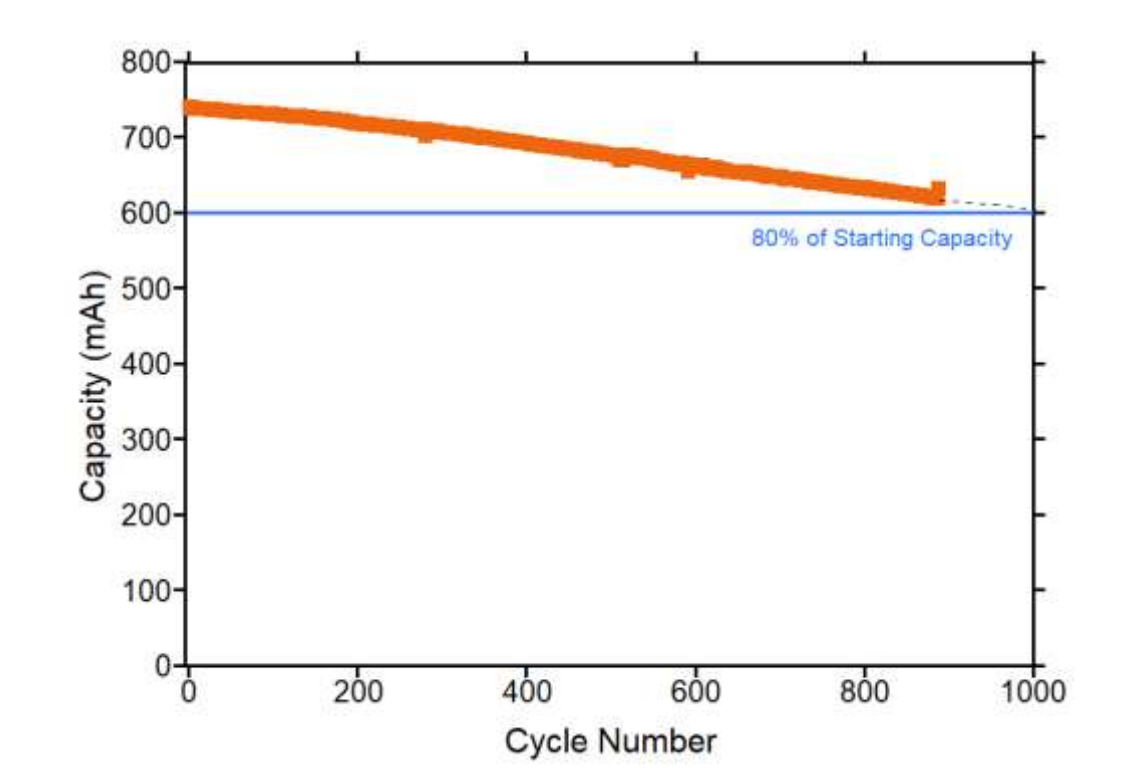
Cell Performance and Research in the BPC



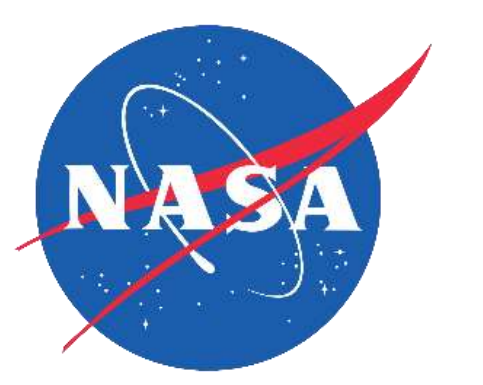
260 Wh/kg NCA/1520T Graphite with CNTs
Leo Cycles- 20% DOD



~750 mAh cell with CNT Additives
1C charge, 1C discharge to 100% DOD



- RIT BPC has been designing a light-weight nano-enabled cubesat power system as part of a NASA Small Spacecraft Technology Program
- 750 mAh cell with CNTs at 100% DOD has reached nearly 900 cycles while maintaining >80% of initial capacity
- RIT 260Wh/kg NCA/1520T Graphite LEO cycling at 20% DOD is currently on test and to-date has reached ~2500 cycles with no appreciable fade.



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Pursuant to the disclosure requirements of the Rochester Institute of Technology, Dr. Ganter of the BPC report that in addition to their RIT employment managing the BPC they also have a financial and fiduciary interest in a battery related company called Celtec Technologies. This company is focused on producing high energy zero-volt capable cells.