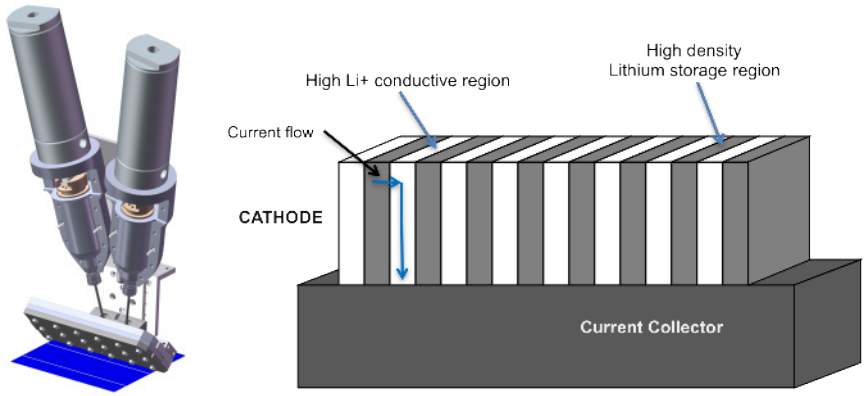
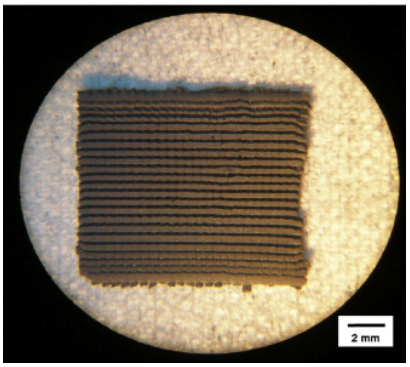
Co-Extrusion Printing for Battery Electrodes: Novel co-extrusion printing technique improves battery performance

PARC offers a proven co-extrusion printing technique that can enhance both the energy and power densities of batteries. A cost-effective way to manufacture structured electrodes, this technique can be applied to both cathodes and anodes for most battery chemistries.



Interdigitated co-extrusion printed battery electrode



Co-extrusion printed cathode ($LiCoO_2$) from one print head

OVERVIEW:

One of the challenges in transitioning from fossil fuels to renewable energy is the availability of cost-effective and portable energy storage. For instance, the development of more efficient batteries at low cost is crucial for the growth of the electric vehicle market. However, given the limited space available within a battery cell, performance is typically optimized for either power or energy density. With typical monolithic battery electrodes, increased power requires greater conductivity, thereby resulting in less available volume for energy storage.

By structuring an electrode with conductive regions that are interleaved with storage regions, current paths can be shortened without compromising capacity. PARC's innovative co-extrusion printing technique can fabricate such structures at high speed. The relative dimensions can be changed to achieve optimal performance in terms of both power and energy.

The benefits

- Up to 20% increase in energy density
- Up to 20% increase in power density
- Up to 20% decrease in cost ($/Wh)
- Transferrable to mass manufacturing
- Scalable to manufacture higher capacity batteries
- Applicable to most battery chemistries

The solution

PARC has developed an innovative co-extrusion printing technique where dissimilar materials can be deposited side by side at high speed. This technique can directly deposit an interdigitated structure as small as 1um in width with high aspect ratios. By changing the print head geometry, the relative thickness, width, and length of the deposited structure can easily be modified. PARC originally developed this technique to print metal gridlines with high aspect ratios on solar cells, and it has been successfully integrated into a pilot production line of a solar cell manufacturing client.

The technique can be applied to battery chemistries where electrodes are coated on metal foils from a slurry, and its process speed, coating width, and reliability are equivalent to those of conventional battery coating equipment.

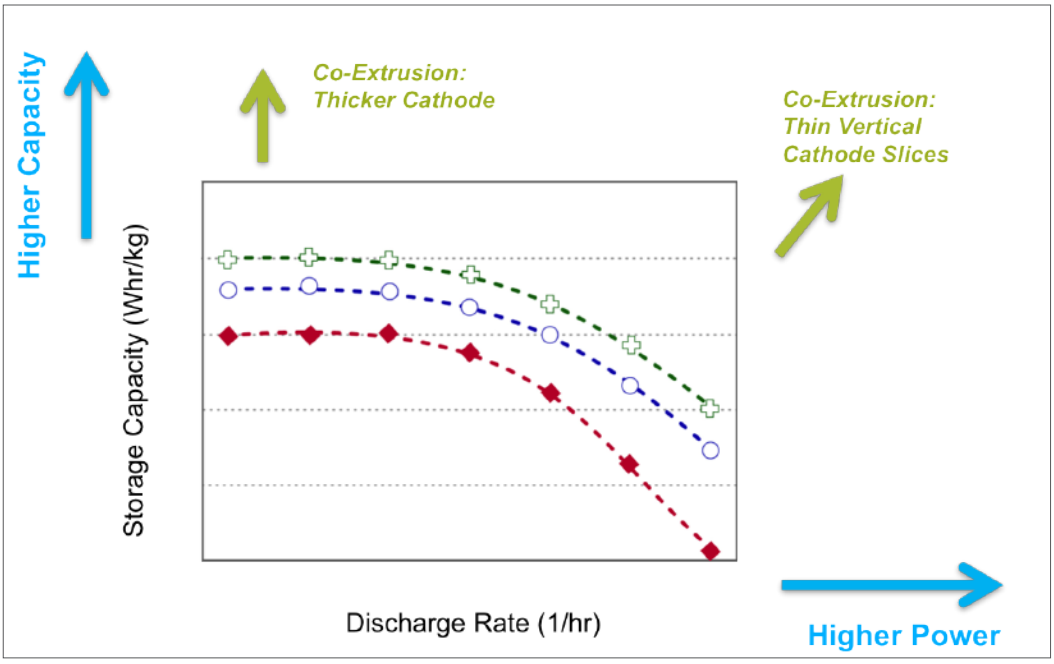
The performance

PARC fabricated $LiCoO_2$ half cells using the co-extrusion printing technique and is currently analyzing the results. Also, performance modeling is being conducted with different battery chemistries, including alkaline, $Li_xMn_2O_4$, $LiCoO_2$, Zn-air, and Ag-Zn. For example, the modeling of a co-extruded structured cathode in a Li-ion battery resulted in a 10-20% improvement in energy density at the same power output. Applying the technique to anodes, additional improvements can be expected.

Take action

PARC is interested in working with battery manufacturers who want to use PARC's innovative technique to improve their current battery performance without changing the fundamental chemistry.

Please contact Business Development: engage@parc.com



Example benefits of co-extrusion printing technique

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