# eJoule Inc
# Lithium Ion Cathode Active Material Production

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| Electric | Energy | Forever |
|---|---|---|
| Using patented DCP and proprietary versatile process chemistries, material performance characteristics are tailored to specific application requirements | eJoule will continue to promote environmentally conscious initiatives, through our energy efficient materials and our business practices. | eJoule will continue to develop and provide safer, more customizable, and better-performing lithium ion battery materials for the benefit of the society. |

# Overview

- eJoule Inc is a California startup company that has developed new synthesis technology for producing oxide Lithium ion cathode active material based on a proprietary equipment set with a process flow that goes directly from solution to cathode powder. This approach is particularly suited to incorporating dopants.
- The new eJoule manufacturing technology provides a scalable platform for producing various Lithium Ion Cathode Active Material compositions. eJoule has focused on improved manufacturing of qualified high energy NMCA and NCA compositions for long range EV (>250 mi, 400 Km ) with capacity >200 mah/gr and doped and coated high Nickel low to no Cobalt compositions as well oxide compositions of interest to specific customers.
- The eJoule World Headquarters and R&D lab is in Fremont CA with a pilot plant in Hsinchu Taiwan. The pilot plant has a 200 MT capacity, laboratory facilities, and capability to evaluate scale of experimental compositions
- The first production plant in China has a 1GWH (1,500MT capacity) which is being expanded to 4,000 MT.
- Plans have been developed for energy efficient zero emission scaled 50K MT plants that could be built anywhere in the world.
- eJoule would welcome investment interest in Series D or participation in a US plant venture with possible DOE ATVM Loan support.

# eJoule's Global Locations

**Fremont, California**
**(Headquarters and R&D Center)**



**Hsinchu, Taiwan**
(R&D and pilot production)

**Changzhou, Jiangsu**
(Cathode Material Production Plant)

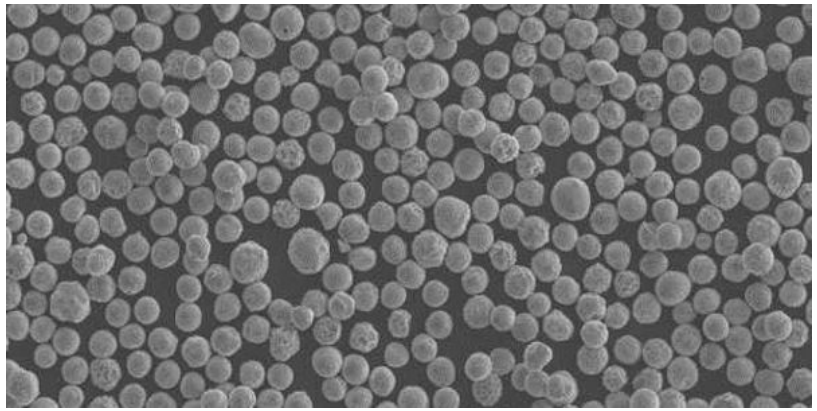

Each Facility has a local test laboratory

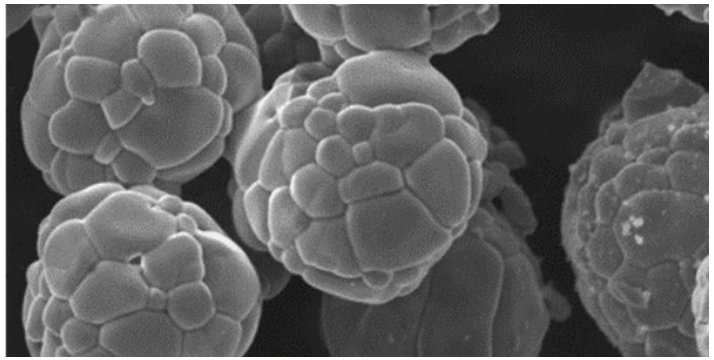
# eJoule Materials

- eJoule produces high-energy cathode materials with greatly reduced defects and impurities and achieves best in-class cathode active material performance by generating from proprietary chemistry a dense cloud of monodispersed droplets. eJoule achieves performance specification by synthesizing cathode materials one particle at a time.
- eJoule's controlled and customizable materials are manufactured with modular and scalable DCP technology, controlled by precise ratio of elements across process chemistries, and can be tailored made to meet requirements.
- eJoule's innovative integrated Dynamic Crystallization Process (DCP) technology enables high production rate and produces uniform high-end high-capacity cathode materials.

**eJoule's Platform Advantage:**

- Increase Ni Content to obtain high energy density (>220 mAh/g)
- Doping of desired element(s) are flexible and controllable
  Adding dopants into the particles improves the cycling stability and safety
- Li content is precisely controlled
- The core equipment is:

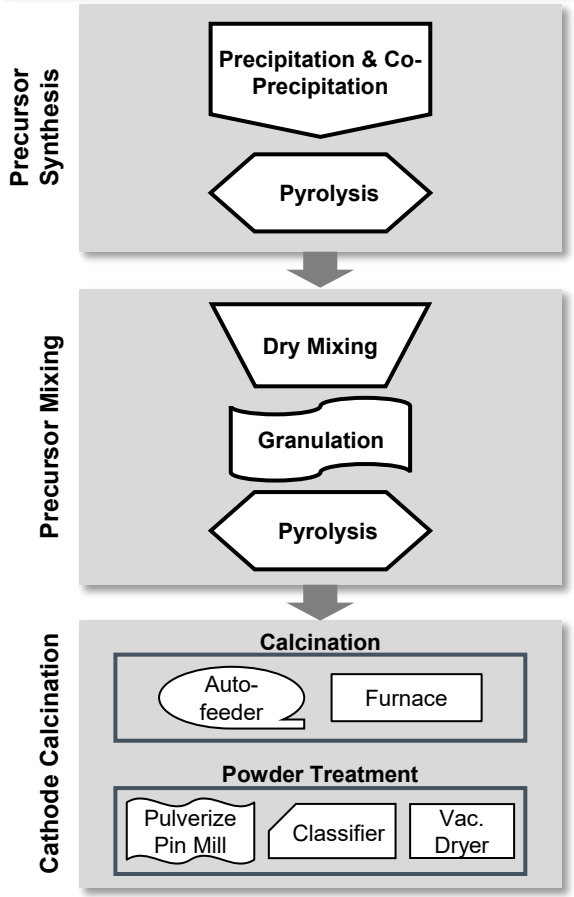




| eJoule <u>Synthesizer Tower</u> | eJoule Fluidized Dynamic Crystallizer |
|---|---|
| • implements Dynamic Crystallization Process (DCP)<br>• Continuous process with unit production | ▪ Based on high throughput Rotary Continuous Feed Furnace with Lithium compatible high purity alumina tube |

# eJoule: Disruptive Process and Chemistry

## Conventional Manufacturing




- *Requires Solid Precursors*
- *Involves Co-precipitation*
- *Non Uniform Particle Sizes*
- *Multi-step Batch Process*
- *Solid Calcination Process*
- *Requires Pulverizations*

- ✗ Complex, labor, energy & time intensive (multiple day production time)
- ✗ Requires additional chemicals, introduces impurities, safety issues
- ✗ Limited power performance, compromised yield
- ✗ Batch process; Single material chemistry at a time

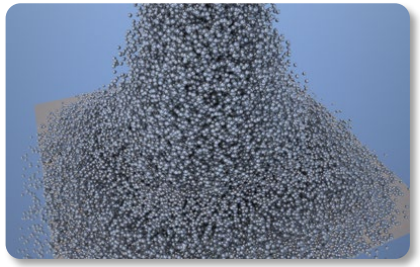
ANL and others have published evaluation of energy use and cost of this process

## eJoule

*Dynamic Crystallization Process (DCP)*

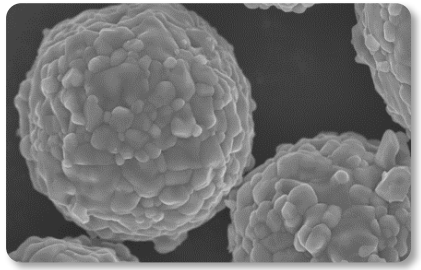
### Proprietary Chemistry

- *No precursors*
- *No solid calcination*
- *No pulverizations*



### eJoule DCP

- *Digital, dynamic & direct*
- *Builds **one crystal at a time***
- *Uniform*
- *Precise control of:*
  - *Crystallinity*
  - *Doping*
  - *Morphology*
  - *Size*



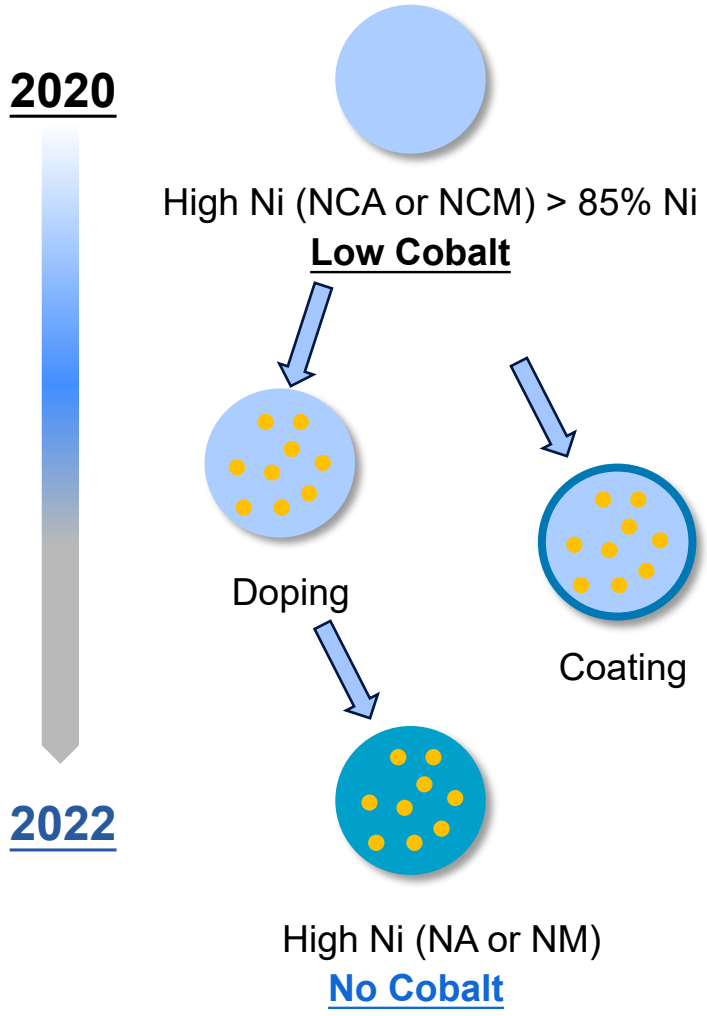
### Superior Cathode Material

- *Highest capacity*
- *Great cycling life, stability*
- *Uniform product distribution*

- ✓ **Highly-scalable, flexible** & **fast** (**6-hour** production time)
- ✓ Low Lithium residue, **safer batteries**
- ✓ **Best** product **performance** in the market
- ✓ **Continuous** process; **Simultaneous multiple** material chemistries

eJoule CAM performance is cost competitive

# eJoule Doped Coated Low to No Cobalt High Energy Cathode Material Capacity > 200 mah/gr




## No Cobalt Cathodes

- Cobalt used in NCA and NCM batteries for two innate properties: **thermal stability** and **high energy density**
- Industry-wide priority to **reduce** or **eliminate** amount of Cobalt used in batteries
  - Relatively expensive component of the cathode
  - Increased risk exposure to potential ethical issues

**Cobalt-free batteries difficult with conventional manufacturing**

- ✘ Inhomogeneous mixing due to inability to mix at the molecular level
- ✘ Some ions cannot be co-precipitated due to high solubility at high pH (Al)
- ✘ Dopants not possible because of no water soluble salts (Ti, Zr, Ga, La)

### eJoule process can eliminate Cobalt

- ✓ Atomic level mixing in the **single droplet** allows for homogeneous mixing
- ✓ Ability to dope / incorporate optimal elements

# Final Notes

- eJoule can synthesize any oxide based chemistry for Cathode Active Materials and other components
- eJoule Inc is at the stage of business development where building a high energy Lithium Ion cathode large volume plant in the United States would be advantageous as well as supportive of the Biden Administration EV Supply Chain Initiative. Large volume is defined by supportive of typical vehicle OEM production targets of 500,000 EV per year of 50,000 MT
- An eJoule plant can be built out in equipment phases and sections subject to available funding. The sections will likely be multiples of 4 GWH. eJoule could build this plant in any suitable location and because of the modularity of the process, segments can produce different compositions or with lines dedicated to specific customers.
- eJoule would welcome investment interest in Series D or participation in a US plant venture with DOE ATVM Loan support.

Charge Ahead
with
eJoule®
Cathode Active Material
and
Partnering on Production

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