PROTOTYPE MACHINE FOR COATING STABILIZED LITHIUM METAL POWDER

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Purpose

To create a cost-effective prototype machine that can create a uniform layer of SLMP, minimum thickness of 150µm, on a pre-existing anode.

Motivation

There is currently no technology cost efficient nor commercially available for coating stabilized lithium metal powder.

Background

Stabilized Lithium Metal Powder, also known as SLMP, is a newly developed product by FMC Lithium Corporation

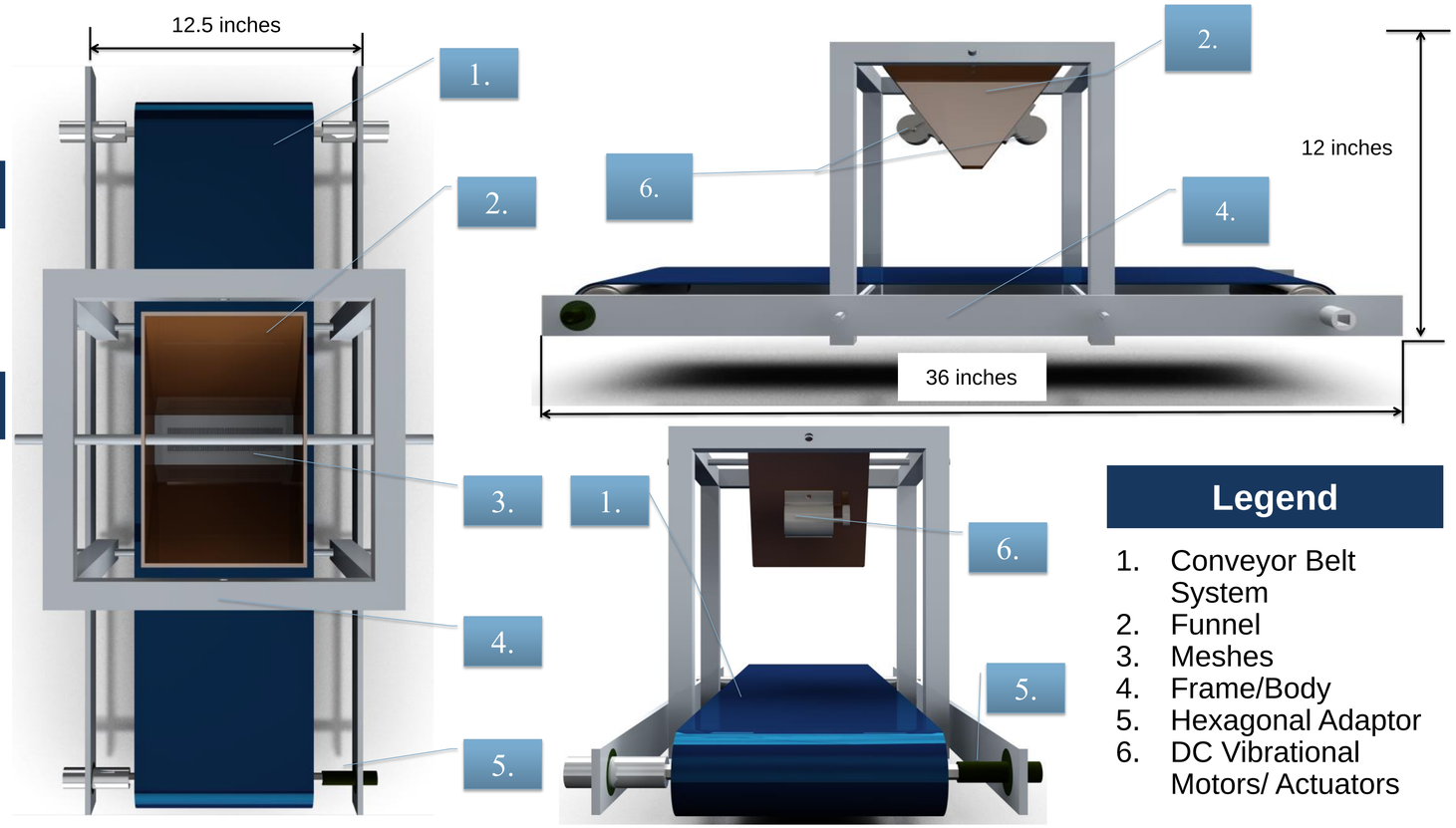
- Metallic Lithium content is roughly 98%
- Particle size: Between 30-60 microns
- Density: 0.534 g/cm^3

SLMP is used as a sacrificial layer of lithium to compensate for the first-cycle capacitance loss.

- Increases the batteries performance by 5 to 15%.
- Increases the energy density by 2-4 times.
- Can be applied to pre-existing anodes

Image 1.1: (Left) Hard carbon electrode.(Right) Hard carbon electrode coated with SLMP

Coating Machine Design



Legend

1. Conveyor Belt System
2. Funnel
3. Meshes
4. Frame/Body
5. Hexagonal Adaptor
6. DC Vibrational Motors/ Actuators

Mechanical Components

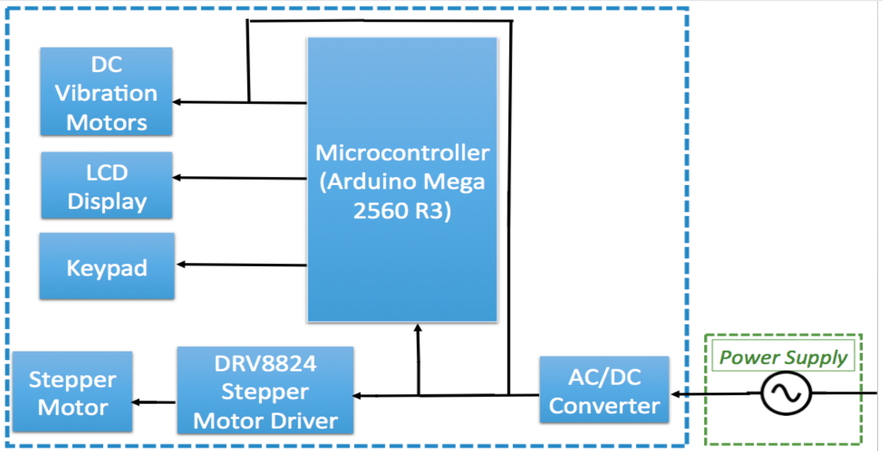
Frame
- Material : A36 Steel

Funnel
- Material: A36 Steel
- Angle of incline: 56.3 degrees

Meshes
- Material: Steel Wire Cloth
- Open Diameter Size:0.0024inches, 0.0029inches,0.0041 inches

Conveyor Belt System
- Loading Torque Required: Minimum of 0.8 N-m
- Rollers
  Diameter 1.9 Inches
- Belting
  Material: Elastomer Rubber (mixture of synthetic rubber, natural rubber, CH_4, S, and ZnO)
  Friction Coefficient: 0.7
- Bearing
  Radial double shielded bearing
  Max RPM: 18,000
- Hexagonal Adaptor
  3D Printed Print
  Material : ABS plastic

System Overview



Electrical Hardware

- Gear Bipolar Stepper Motor
- Arduino Mega 2560 R3
- 3x4 Numerical Matrix Key Pad
- 16x2 Character Display
- 12 V- 5A Power Supply (60 W)
- 12 V DC Vibration Motors:
  (1)-3000 RPM-50HZ
  (1)-4000RPM-66.67 HZ

Future Recommendations

- Addition of a stabilizing base plate as foundation for entire prototype
- Experimentation with different funnel material and support rod material
- Exploration of linear vibrational methods rather than vertical displacements
- Addition of positioning and weight sensors