ThinkClock Battery Labs

Sensing, Modelling, Analytics

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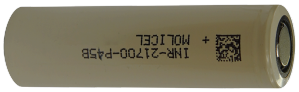
We want to asses your skills related to fron-end and backend developent. Please, create a web interface to display the characteristic information about a battery cell as described below.

1) **Use a representative image of the cell (to be uploaded by the user)**



2) **Generate a unique 10-digit Cell_ID and a Bar Code automatically and use it as a unique identifier for the cell (sample shown below)**

3) **The page should have option to enter the following meta information. The boxes should be initialized to default values as shown below.**

Meta Information:

Cell Condition (New or Recycled):	**Recycled**
Manufacturer	**Molicel**
Model	**INR21700-P45B**
Type	**Li-ion**
Form factor	**Cylindrical 21700**
Mass	**70 (g)**
Height	**70.15 (mm)**
Diameter	**21.55 (mm)**
Volume	**25.59 (cm^3)**

Electrical Paramaters:

Nominal Voltage: 3.6 (V)
Nominal energy: 16.2 (Wh)
Nominal charge capacity (Ah): 4.5 (Ah)
Voltage Range: 2.5-4.2 (V)

Current (continuous): 8.61 A
Current (peak): 17.5 A
Power (continuous): 25.6 W
Peak (peak): 50.0 W

Energy Density (Gravimetric): 154 Wh/kg
Energy Density (Volumetric): 375 Wh/l

Power Density (Gravimetric): 837 W/kg
Power Density (Volumetric): 2.04 kW/l
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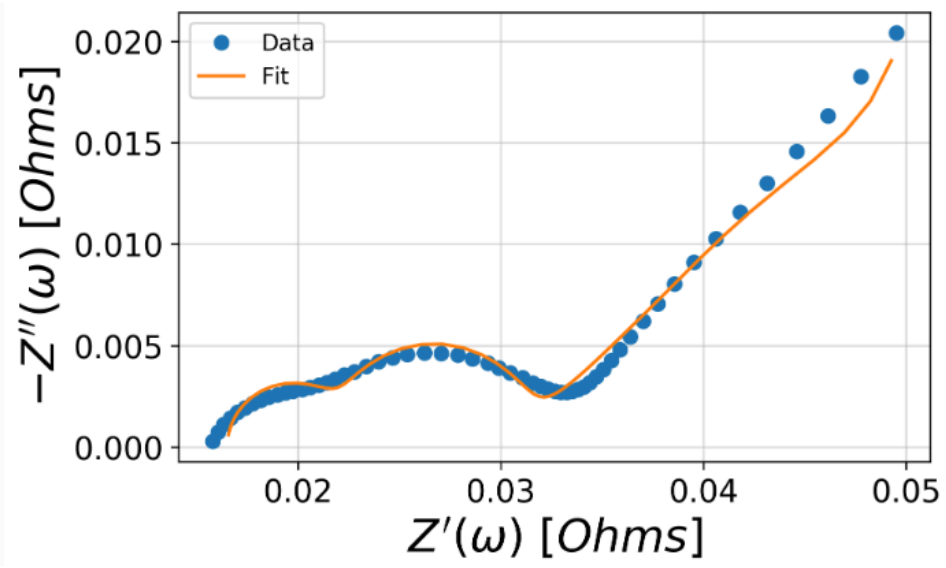
4) **The webpage should have an option to upload the data from a file: (similar to exampleData.csv which you can download from here)**

https://impedancepy.readthedocs.io/en/latest/_downloads/320671c0bb666e4d6ac487c9d7ff1679/exampleData.csv

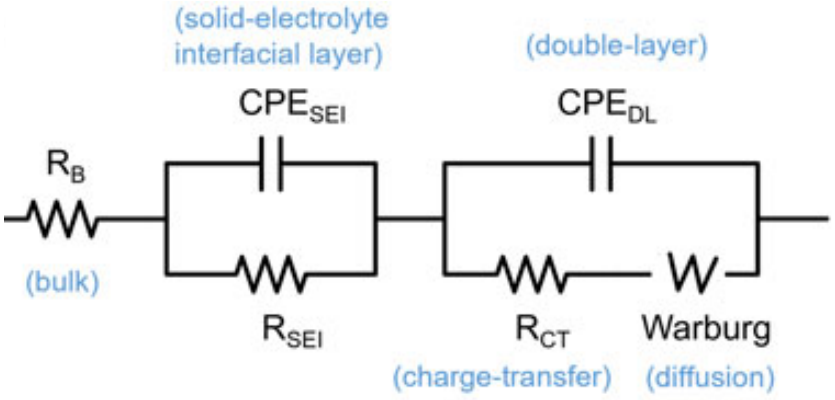
5) **After uploading the data, the webpage should transform the data to produce the results listed below using this python library:**

https://impedancepy.readthedocs.io/en/latest/getting-started.html

a) **Bode plot (use plotly/dash to display an interactive plot)**



b) Display this Equivalent Circuit Model and the values of the predicted circuit parameters as a Table. You may recreate the diagram to make it more appealing.



R: resistance
CPE: capacitance
W: Warburg impedance

Paramater	Value	Explanation	Visual Indicator (Show visually the current value compared to min and max values, assume min-max values of each

			paramater)
Rb		**Electrolyte resistance**	
R_SEI		**Resistance due to SEI layer**	
CPE_SEI		**Capacitance due to SEI layer**	
R_CT		**charge-transfer resistance that models the voltage drop over the electrode–electrolyte interface due to a load**	
CPE_DL		**Double-layer capacitance that models the effect of charges building up in the electrolyte at the electrode surface**	
W_Warburg		**Frequency-dependent Warburg impedance models diffusion of lithium ions in the electrodes**	

c) **Display the State-of-the-Health (SoH) of the battery cell using an icon similar to shown below along with the %SoH.**

The %SoH = Rb (current)/Rb (Max) x 100. (Assume max value for Rb)