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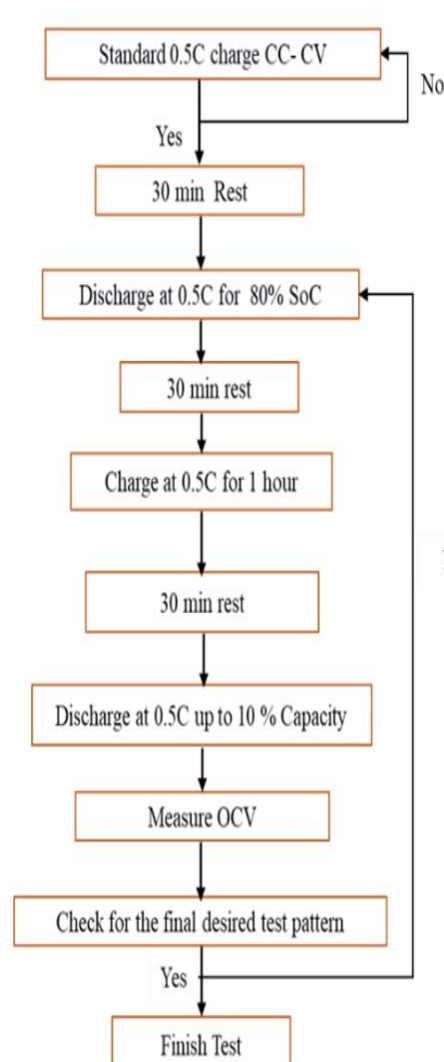
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## Background

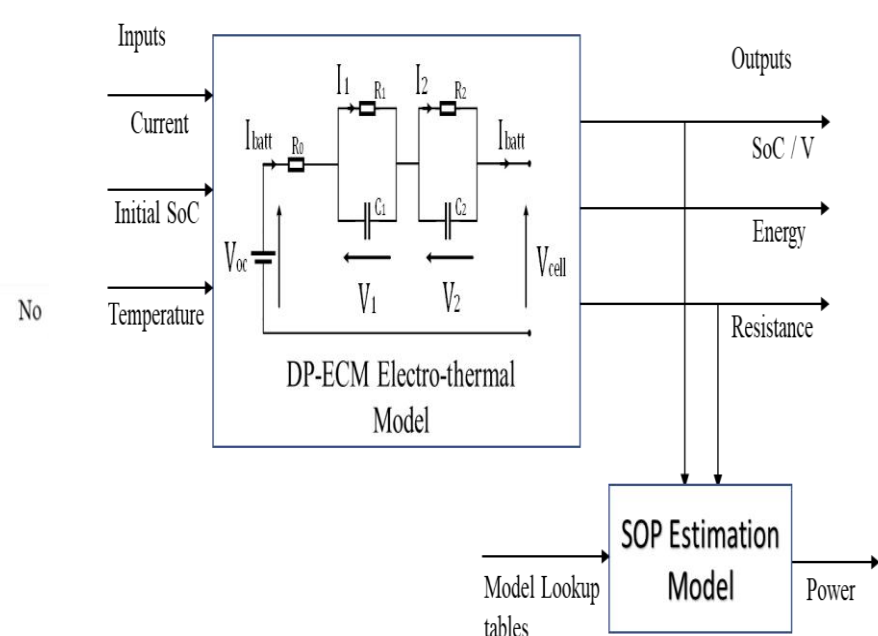
- State of power (SoP) model is developed based on the pulse trained internal resistance evolution approach and hence the power is estimated by determining the rate of internal resistance increase.
- A hybrid pulse power characterization (HPPC) test results are used for extraction of the impedance parameters.
- The validation of the SoP model is also performed by using both dynamic Worldwide Harmonized Light vehicles Test Cycles (WLTC) and static current validation profiles achieving promising results with root mean square error (RMSE) of 2 % and 1 % respectively.

## Methods

HPPC pattern used for SoP estimation



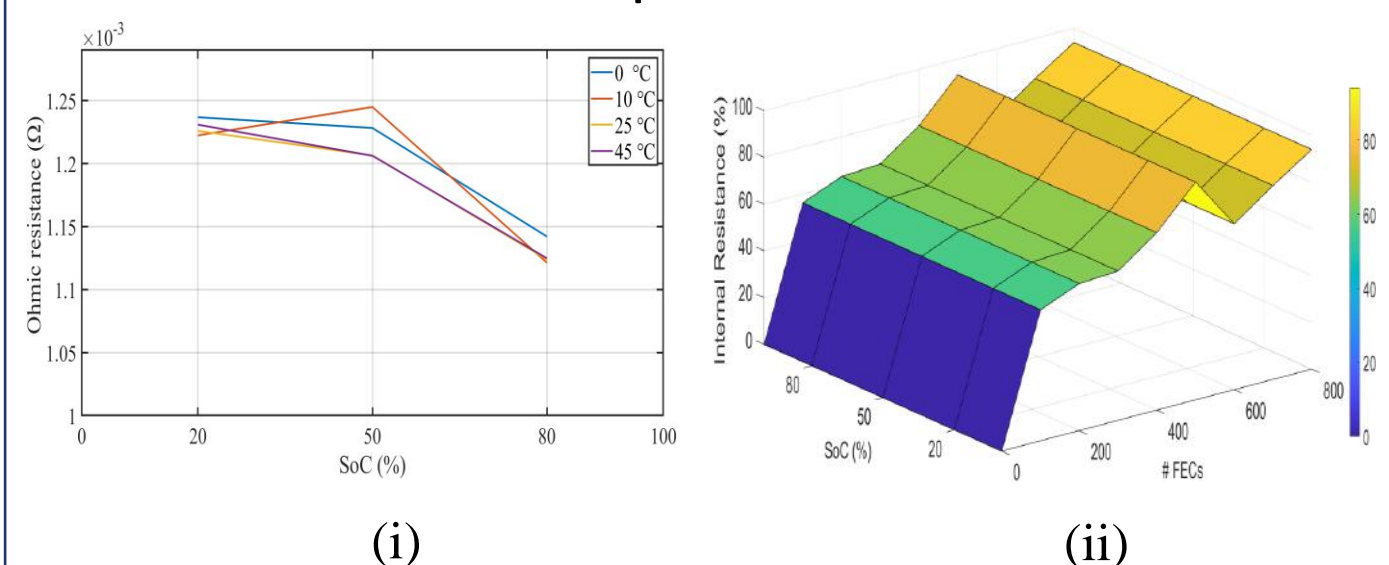
**Fig. 1.** Flowchart for HPPC test Pattern & Overall cycling Aging characterization procedure.



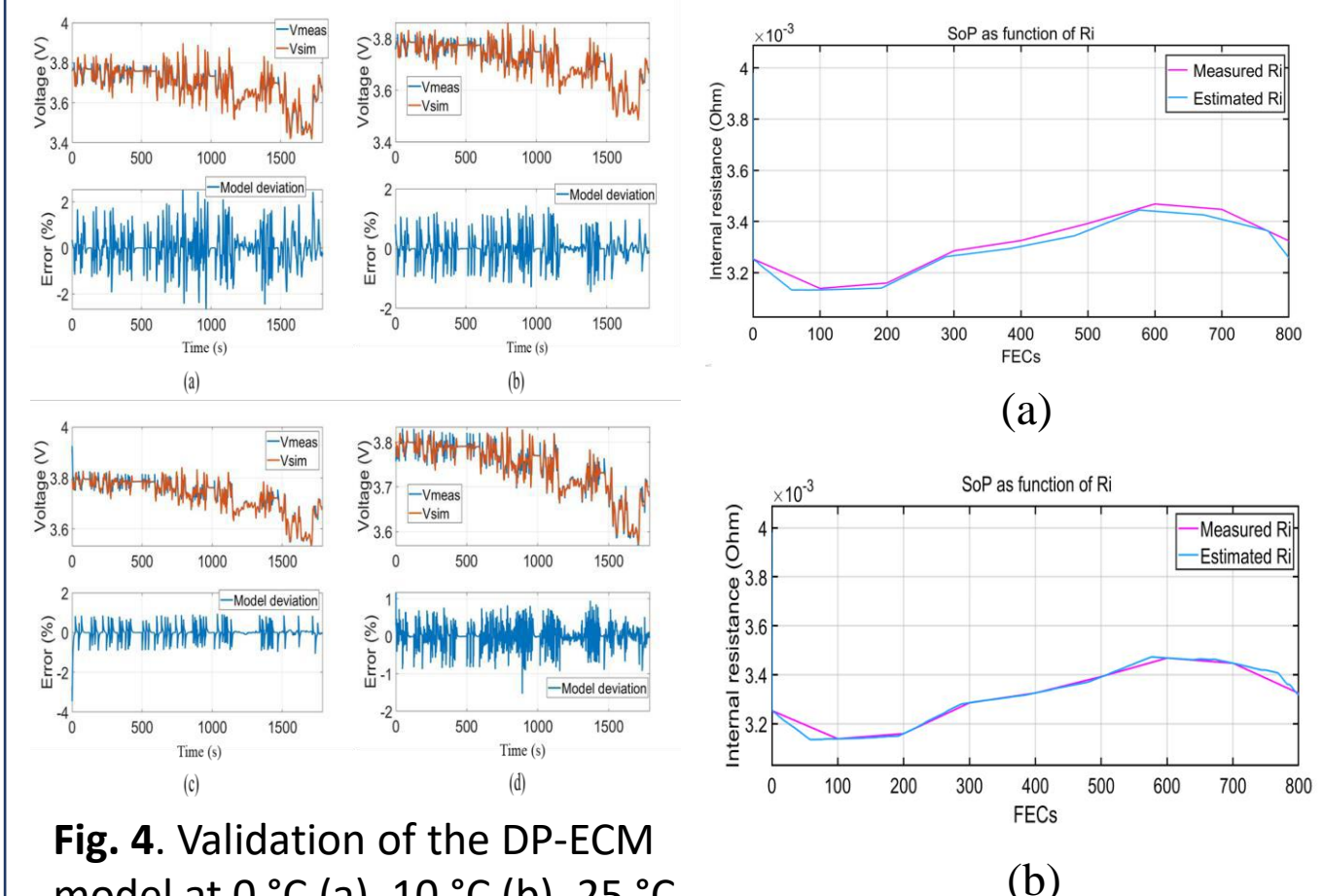
**Fig. 2.** Schematic representation of SoP model coupled with DP-ECM.

## Principal findings

The principal findings of the study incorporates: Both experimental and model-based simulation outputs.



**Fig. 3.** Representative experimental results of:  
(i). TBLI-based  $R_0$  ECM parameter,  
(ii). IR versus SoC relationship with 3D surface fitting.



**Fig. 4.** Validation of the DP-ECM model at 0 °C (a), 10 °C (b), 25 °C (c), and 45 °C (d).

**Fig. 5.** SoP model validation (a) WLTC profile, (b) Static current profile.

## Conclusions

- New contributions was made for SoP estimation model development by considering a thorough investigation on the IR evolution of EV battery cells subjected to cycling aging profile.
- Model validation with less than 2 % error found.