



Novel SOC and SOH Estimation Through Sensor Technology



ARPA-e Award#: DE-AR0000277

Southwest Research Institute®

Technology Description

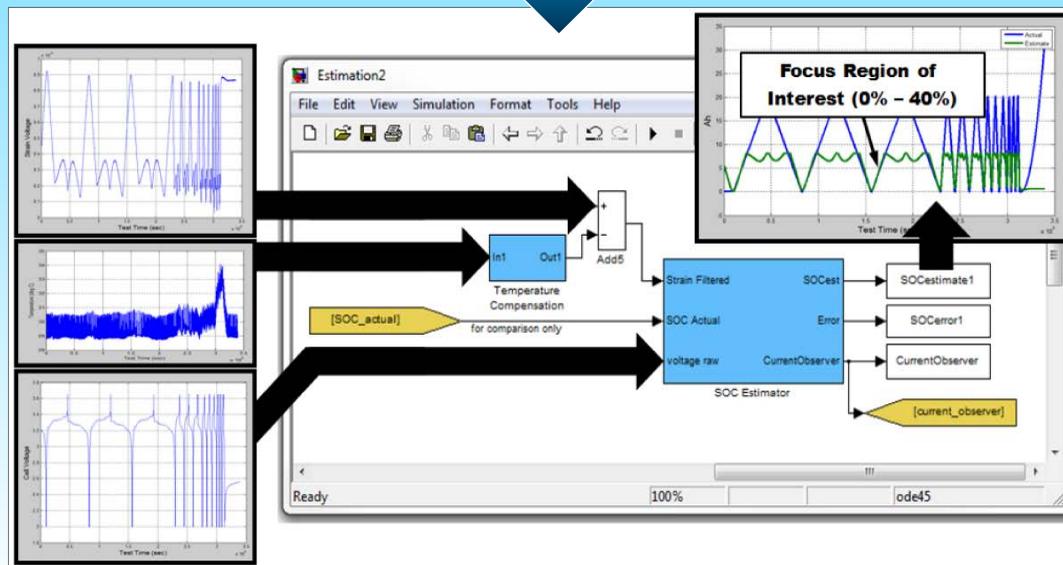
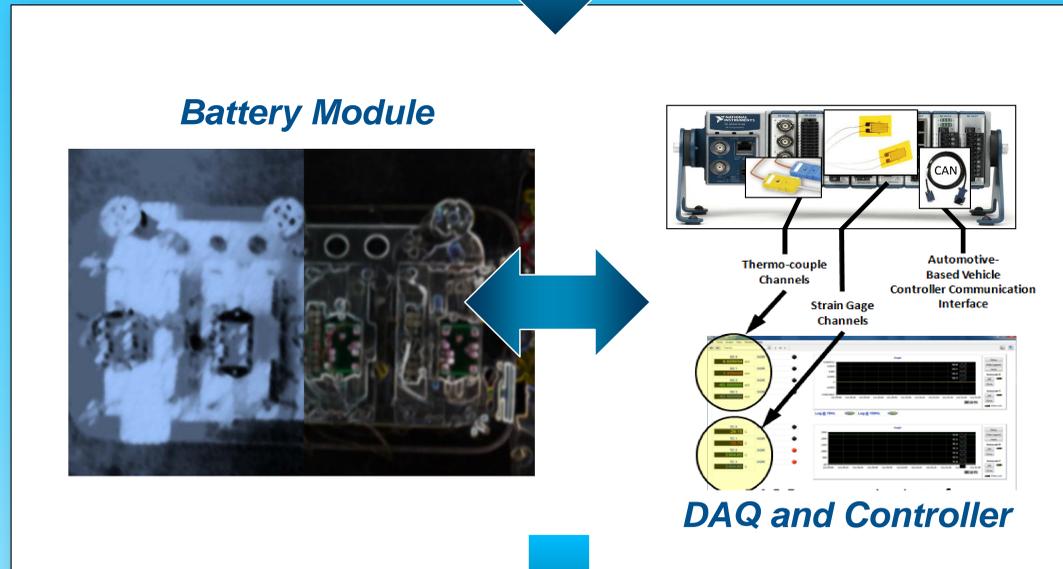
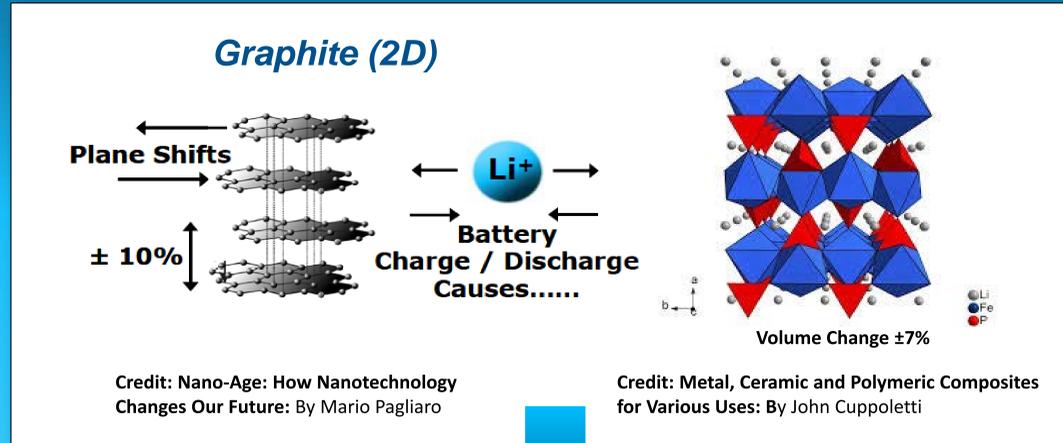
- Strain is a directly measured signal that reflects the battery volume changes caused by electrode intercalation/de-intercalation
- Strain-gauge-based model and control algorithms can accurately define the correlation between strain versus SOC/SOH, and the results can be transferred into a representation appropriate for in-vehicle control system or energy storage system development

Value Proposition

- The approach is to combine fast, direct sensing hardware with modern control algorithms. It is targeted to enhance the controllability and potential reliability of energy storage systems by providing the following benefits:

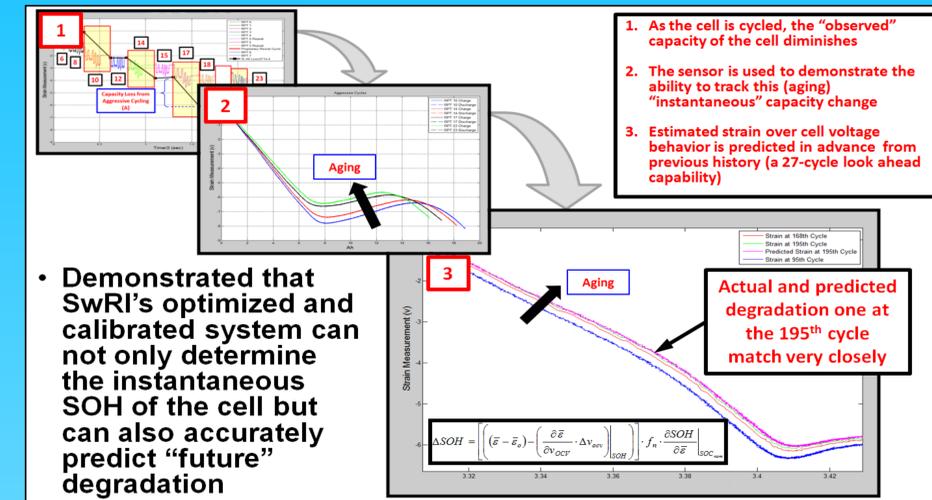
1. Simplicity and robustness
2. Accuracy with low cost implementation
3. Direct, online SOC and SOH health monitoring

| Metrics | State-of-Art | SwRI |
|-----------------|--------------|-----------------|
| SOC accuracy | ~5% | ~2.5% over life |
| SOH sensitivity | N/A | 0.00771%/cycle |
| SOH accuracy | N/A | ~1.7% error |



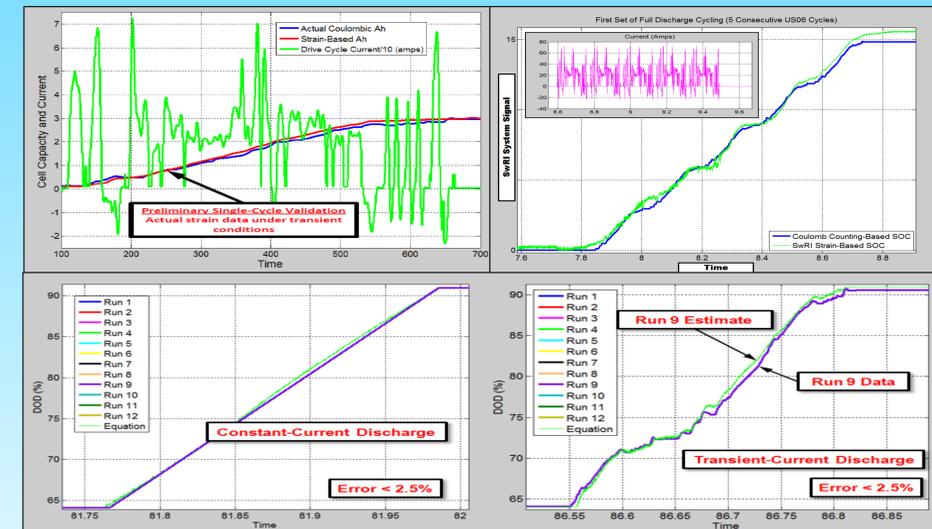
Project Results

- SOH measurement/algorithm can be used for detecting present degradation and anticipating future degradation rates



- Demonstrated that SwRI's optimized and calibrated system can not only determine the instantaneous SOH of the cell but can also accurately predict "future" degradation

- Strain-based SOC comparison against coulomb counting for a battery pack design undergoing both constant-current and transient US06 driving cycles



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