Overcharge Study in $Li_4Ti_5O_{12}$ Based Lithium-Ion Pouch Cell

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The Hawai'i Natural Energy Institute (HNEI) is leading a teamengaged in the research, development, deployment, and analysis ofgrid-scale battery energy storage systems (BESS) that are designedfor system control and power quality support at the generation,transmission, and distribution levels. The program aims to identifyhigh value BESS applications at various system levels, developcontrol algorithms that maximize the benefit to the grid/customerand the lifetime of the BESS, and evaluate and optimize thosealgorithms under real world operating conditions.

Overcharge tolerance has often been studied from a safety standpoint (e.g. thermal runaway), but rarely from a durability standpoint.A quantitative battery diagnosis was developed to analyse an overcharge event in a commercial $Li_4Ti_5O_{12}$ || $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$lithium-ion pouch cell and the subsequent cycle aging behaviour [1].

Using an electrochemical inference technique and the degradationemulation *'alawa* toolbox [2-4], quantitative diagnoses of two cells enduring the same cycle aging conditions, with or without the overchargeevent, were performed. From this analysis, ahypothesis of localized blockage of the ionic conduction pathway due to gas accumulation was proposed as the mechanism drivingthe degradation [1], Figure 1. This hypothesis was then validated using X-ray computerized tomography (CT scan) and half-cell experiments.

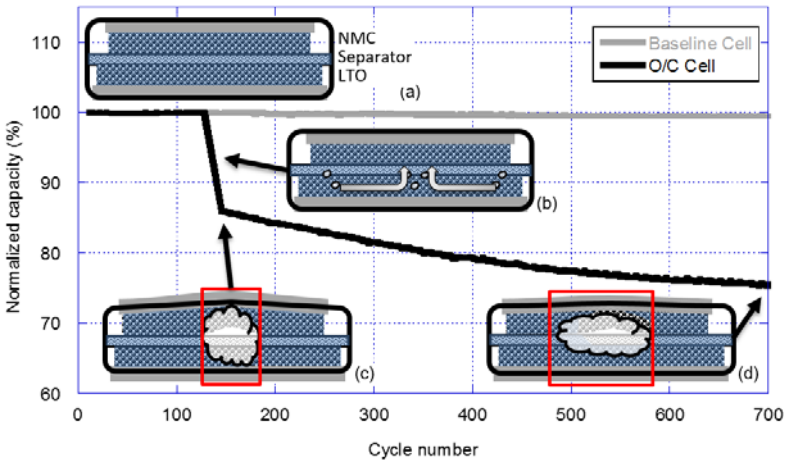

Figure 1: Proposed overcharge degradation mechanism.

[1]A. Devie,M. Dubarry, and B. Y. Liaw,J. Electrochem. Soc., 162 (6) (2015) A1033.
[2] M. Dubarry, C. Truchot and B.Y. Liaw,J. Power Sources 219 (2012) 204.
[3] https://www.soest.hawaii.edu/HNEI/alawa/
[4] M. Dubarry, A. Devie, and B. Y. Liaw, J. Energy Power Sources, 1, (2014) 242.