Complementary analyses of aging in a commercial LiFePO4/graphite 26650 cell - DTU Orbit (30/01/2019)

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In this work we investigate the electrode degradation mechanisms in a commercial 2.5 Ah LiFePO4/graphite 26650 cylindrical cell. Aged and fresh electrode samples were prepared by cycling two cells respectively five and 22 k times. Subsequently the cells were disassembled in a glovebox and the electrode samples were prepared for electrochemical testing in a 3-electrode setup, and for characterization with XRD, XPS and low-kV FIB/SEM tomography. A 1 μm thick CEI (cathode electrolyte interface) layer was observed at the electrode/electrolyte interface of the aged LiFePO4 electrode. Relative to the fresh LiFePO4 electrode, the aged electrode exhibited a larger series resistance which indicates the observed degradation layer increases the ionic resistance. In addition, micron-sized agglomerates, probably a mixture of carbonaceous material and decomposition products from the electrolyte, were observed at the electrode/electrolyte interface of the aged graphite electrode. These layers may contribute significantly to the loss of lithium inventory (LLI) in the cell, and to the loss of active material (LAM) in the graphite electrode. Low-voltage FIB/SEM tomography was used to detect local charging effects of graphite particles in the carbon electrode, an effect of poor dissipation of the electric charge to the ground after the sample interaction with the electron beam. The charging effects were primarily observed in the aged electrode and most of the locally charged particles were found to be close to the electrode/electrolyte interface, indicating a poorly percolating graphite network near this interface.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Imaging and Structural Analysis, Electrochemical Materials and Interfaces, Applied Electrochemistry, Aalborg University, Uppsala University
Pages: 454-468
Publication date: 10 Sep 2018
Peer-reviewed: Yes

Publication information
Journal: Electrochimica Acta
Volume: 284
ISSN (Print): 0013-4686
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.01 SJR 1.439 SNIP 1.101
Web of Science (2017): Impact factor 5.116
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.74 SJR 1.355 SNIP 1.177
Web of Science (2016): Impact factor 4.798
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.86 SJR 1.321 SNIP 1.324
Web of Science (2015): Impact factor 4.803
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.59 SJR 1.378 SNIP 1.456
Web of Science (2014): Impact factor 4.504
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.44 SJR 1.427 SNIP 1.587
Web of Science (2013): Impact factor 4.086
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 3.99 SJR 1.644 SNIP 1.574
Web of Science (2012): Impact factor 3.777
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 4.15 SJR 1.615 SNIP 1.788
Web of Science (2011): Impact factor 3.832
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.685 SNIP 1.715
Web of Science (2010): Impact factor 3.65
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.523 SNIP 1.615
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.524 SNIP 1.458
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.551 SNIP 1.568
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.531 SNIP 1.726
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.484 SNIP 1.516
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.362 SNIP 1.567
Scopus rating (2003): SJR 1.637 SNIP 1.505
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.534 SNIP 1.441
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.312 SNIP 1.376
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.889 SNIP 1.161
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.936 SNIP 1.183
Original language: English
Keywords: Cathode electrolyte interface, Degradation mechanisms, Electrochemical impedance spectroscopy, Focused ion beam, Li-ion battery
DOIs:
10.1016/j.electacta.2018.07.124
Source: Scopus
Source-ID: 85050697400
Research output: Research - peer-review ; Journal article – Annual report year: 2018