



Comment on “A Comparative Testing Study of Commercial 18650-Format Lithium-Ion Battery Cells” [*J. Electrochem. Soc.*, 162, A1592 (2015)]

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A diligent reader brought to our attention further inconsistencies in cells sold under the UltraFire label. As shown in Fig. 1, contributors to online forums physically opened such cells to find a large shell containing a much smaller cell within.¹ Our reader confirmed that some UltraFire cells opened by his research group had made similar discoveries. Their analysis found other UltraFire cells contain only very short electrode foils, which, as shown in Fig. 2, filled the cell only partially.²

In response to these revelations, which added to the highly unfavorable findings regarding UltraFire-labelled cells published in our paper, our research team elected to disassemble the cells we had previously tested.

As can be seen in Figs. 3 and 4, neither sample of the tested UltraFire cells was found to contain a smaller cell unit inside. Cross-wise dissection of a further UltraFire cell sample, shown in Fig. 5, did not highlight obvious unfilled spaces in the cell.

However, the cells were nonetheless found to have exceptionally small electrode foils for 18650 cells. As listed in Table 1, the UltraFire cells comprised only 73% and 74% of the area of the Sanyo and Panasonic cells, respectively. Opened samples of the tested Sanyo and Panasonic cells are shown in Fig. 6.

Small electrode foil area directly contributes to both low cell capacity and high internal resistance. It is therefore highly probable that this is a key cause for the low test performance identified in our paper. Determining to what extent additional factors such as component quality also play a role is a prospective topic for further research work.

We believe sharing these additional findings will provide value to the community.



Figure 1. Opened UltraFire-labelled cell consisting of large shell with small internal cell (republished with permission from Ref. 1).

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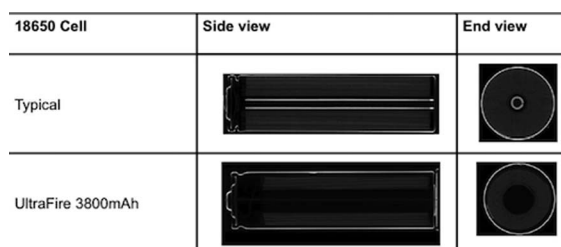


Figure 2. CT scans of typical and UltraFire-labelled cells (published with permission from Ref. 2).



Figure 3. Opened sample of UltraFire TR18650 4200 mAh cell tested in original paper.



Figure 4. Opened sample of UltraFire TR18650 4900 mAh cell tested in original paper.

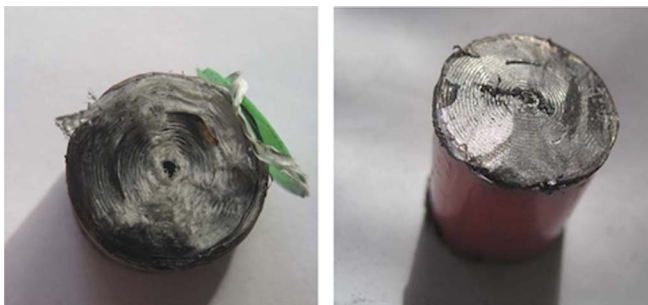


Figure 5. Cross-sections of sample of UltraFire TR18650 4200 mAh cell tested in original paper. Left: cross-section near cell terminal; right: cross-section near middle of cell.

Table I. Comparison of electrode foil area of opened samples of tested cells.

Cell Type	Electrode length (cm)	Electrode height (cm)	Est. Electrode Area (cm ²)
Pan3100	57	6.0	342
Pan3400	57	6.0	342
San2600	64	5.4	346
UF4200	47	5.4	254
UF4900	47	5.4	254



Figure 6. Opened sample of the other cells tested (from top: Panasonic NCR18650A, Panasonic NCR18650B, Sanyo UR18650FM).

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