

An Experimental Checklist for Reporting Battery Performances

Cite This: *ACS Energy Lett.* 2021, 6, 2187–2189

Read Online

ACCESS |



Metrics & More



Article Recommendations

Researchers submit their papers to a journal to share new scientific findings and broaden the knowledge of the journal's wide readership. Only accepted manuscripts that have undergone peer review are published in a journal such as *ACS Energy Letters*. While reviewing submitted manuscripts, we (editors and reviewers) often encounter papers in which the authors have overly simplified the experimental details. Even though a manuscript may present valid conclusions and meaningful discussions, its impact is diminished if the results cannot be reproduced easily. In order to avoid this ambiguity, we carefully examine the experimental methods that are important parameters for determining the validity of the reported results during the editorial review (Figure 1).

In any research domain, the reliability of the results and methods is essential. Only reliable results, obtained through appropriate and adequate experiments, can lead to reasonable interpretations. The Experimental Methods section should provide sufficient information for readers to assess the validity of the reported results and for other researchers to reproduce the experiments and the results.¹

In the interest of conciseness, well-written experimental methods are detailed while including only the information essential for reproducing the results. However, important evaluation parameters that are omitted by authors can easily go unnoticed during the review process, despite their knowledge being critical in establishing the outcome of the experiments. For example, in the battery field, the electrochemical performances of cells can vary, despite featuring the same electrode materials. The performance can vary significantly depending on the loading level of the electrodes, electrolyte composition, cell type and configuration, etc. These factors tend to be overlooked because they are usually not the foci of the designed experiments. To avoid these critical omissions, we have compiled a general checklist of the experimental details (Table 1) that should typically be provided in papers reporting on battery performances.

The checklist includes elementary information requirements relating to battery assembly and evaluation conditions. The contents of the checklist are based on the consensus developed by many researchers' empirical studies in the battery field. Accurately providing the information prescribed by the checklist supports the reliability of the reported results, enables reproduction, and facilitates comparison of the performances with previously reported values. Therefore, we recommend that authors consult the checklist when reporting experimental



Figure 1. Checking the list of experimental parameters during the editorial review process. (Source: niroworld/shutterstock.com)

details and complete it prior to manuscript submission. Authors are requested to tick the appropriate box if the corresponding information is provided in the main text or provide acceptable reasons under additional comments if not available. This table can be included in the Supporting Information for publication.

However, because most of the checklist items pertain to the field of lithium-ion batteries, the proposed checklist is more of a guideline than a standard. The suggested items may not be applicable to other research areas such as lithium–air batteries, aqueous batteries, and zinc-ion batteries. Moreover, other fields of energy research have completely different evaluation criteria. Nevertheless, the main purpose of the proposed checklist is to illustrate the tabulation of the key experimental information (associated with a specific research field) required to ensure the clarity and reliability of the reported performance results. Thus, the checklist can be adapted for different fields of research. While such exercises may be tedious, a checklist serves as an interactive medium to facilitate the reproduction of experiments and performance results, as well as to convince reviewers of the validity of a procedure used to verify a hypothesis. We strongly recommend that authors submit similar checklists for clear communication. The use of a checklist, such as the one proposed, prevents authors from

Published: June 11, 2021



Table 1. Recommended Checklist of Experimental Details in Reports of Battery Performance

	Confirmed	N/A	Additional comments
Battery assembly	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Design of cell structure (e.g., 2032-coin cell, 3 cm * 5 cm pouch type cell, or others)			
The relative weights of the active materials, conducting agent, and binder in an electrode			
The loading level of the active material (mg/cm ²) in the electrode			
The capacity balance between the cathode and anode (N/P) in a full cell			
Lithium metal thickness and size (lithium metal cells)			
Composition of electrolyte and details of additives			
The amount the electrolyte and the ratio of electrolyte to active material.			
Specifications of used materials (amount in grams, purity, concentration, vendor, etc.)			
Evaluation of electrochemical performance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Type of cell (half or full cells) used for the electrochemical tests			
Number of the stacked electrodes and the corresponding total capacity (full cells)			
Cell capacity (mAh) or areal capacity (mAh/cm ²)			
Theoretical capacity to determine C-rate and C-rate for each electrochemical test			
The range of the operating voltage			
The ambient temperature during electrochemical evaluations			
Specified C-rate for each electrochemical test			
First cycle or initial pre-cycling conditions and electrochemical data			
Initial charge–discharge Ah efficiency and the capacity evaluated at a low C-rate (e.g., 0.1 C)			
Pressure applied to the cell (if additional pressure is applied during cycling)			
Method of calculation of energy density (material, electrode, cell, pack level, etc.)			
Electrochemical testing procedures and CC/CV mode			

omitting or neglecting critical experimental details, assists reviewers in objectively evaluating the reported results, and

ensures that the findings are comprehensively communicated to readers.

Yang-Kook Sun, Senior Editor, *ACS Energy Letters* orcid.org/0000-0002-0117-0170

■ AUTHOR INFORMATION

Complete contact information is available at:
<https://pubs.acs.org/10.1021/acseenergylett.1c00870>

Notes

Views expressed in this editorial are those of the author and not necessarily the views of the ACS.

■ RELATED READINGS

(1) Stephan, A. K. Standardized Battery Reporting Guidelines. *Joule* 2021, 5, 1–2.