Keeping up standards in scientific publishing

Oliver Graydon – Chief Editor, Nature Photonics
Why standards are important to journals

• Validity and Creditability
  - helps gives reviewers/community confidence in findings (big claims)
  - helps stamp out flawed and erroneous studies

• Transparency and Reproducibility
  - provides a clear set of methods as to how things have been done

• Benchmarking and figures of merit
  - often allows quantitative comparisons to be made between different experiments and studies
  - allows creation of key figures of merit
Successful standards in photonics

- solar cell characterization: NREL chart of photovoltaic efficiency

### Best Research-Cell Efficiencies

<table>
<thead>
<tr>
<th>Multijunction Cells (2-terminal, monolithic)</th>
<th>Thin-Film Technologies</th>
<th>Crystalline Si Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW = lab-based</td>
<td>b-Si</td>
<td>Single crystal (concentration)</td>
</tr>
<tr>
<td>HMM = monolithic</td>
<td>CIGS (concentrator)</td>
<td>Single crystal (non-concentrator)</td>
</tr>
<tr>
<td>NMM = multi-metal</td>
<td>CIS</td>
<td>Multijunction</td>
</tr>
<tr>
<td>Three-junction (concentrator)</td>
<td>CdTe</td>
<td>Silicon heterostructures (HT)</td>
</tr>
<tr>
<td>Two-junction (concentrator)</td>
<td>A-Si</td>
<td>Thin-film amorphous</td>
</tr>
<tr>
<td>Four-junction (non-concentrator)</td>
<td>A-Si:H</td>
<td>Thin-film crystalline</td>
</tr>
</tbody>
</table>

Emerging PV: Dye-sensitized cells, Perovskite cells (not stabilized), Organic cells (various types), Organic heterojunctions, Inorganic cells (CZTS/Se), Quantum dot cells (various types).

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Checklists at Nature journals

- Introduced to ensure **best practice**
- List of questions / requests that authors have to answer
- Completed prior to peer review, sent to reviewers and most are published!
- Editorial Policy (ethics, data handling)
- Life Sciences Reporting Summary in 2017 (statistics, code, cells, MRI, flow cytometry)
- Discipline specific (solar cells 2015, lasers 2017)

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**Solar Cells Reporting Summary**

Nature Research wishes to improve the reproducibility of the work that we publish. This form is intended for publication with all accepted papers reporting the characterisation of photovoltaic devices and provides structure for consistency and transparency in reporting. Some list items might not apply to an individual manuscript, but all fields must be completed for clarity.

For further information on Nature Research policies, including our data availability policy, see Authors & Reference.

### Experimental design

1. **Dimensions**
   - Area of the tested solar cells
   - Method used to determine the device area
2. **Current-voltage characterization**
   - Current density-voltage (J-V) plots in both forward and backward direction
   - Voltage scan conditions (i.e. maximum solar illumination, speed, current bias)

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**Reporting Summary**

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*For Final Submission*: please carefully check your responses for accuracy; you will not be able to make changes later.

#### Statistical parameters

- When statistical analyses are reported, confirm that the following items are present in the relevant location (e.g. figure legend, table legend, main text, or Methods section).

  - **n/a**
  - **Confirmed**

  - **The sample size(s)** (n) for each experimental group/condition, given as a discrete number and unit of measurement
  - **An indication of whether measurements were taken from distinct samples or whether the same sample was measured repeatedly**
  - **The statistical test(s) used AND whether they are one- or two-sided**
  - **Only common tests should be described briefly; describe more complex techniques in the Methods section.**
  - **A description of all covariates tested**
  - **A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons**
A forum for discussion

• Publish articles to stimulate discussion on controversial / troublesome issues where standards could help e.g. imaging
Challenges for standards

• Who gets to choose / define them?
• Should they be mandatory?
• Achieving widespread adoption by community
• Updated as technology and science evolves
• Barriers to entry, ensuring easy, global access?
Keeping up standards

Scientific claims, particularly those related to devices, are often backed up by standardized characterization. In fields without accepted standards, is it beneficial to strive to establish them?

As hard as it is to believe, almost 60 years after the invention of the laser, at conference lunches and laboratory meetings alike, debate over which devices are and are not lasers is rife. In 2017, we announced\(^1\) a laser ‘checklist’ that should be completed by the authors of relevant papers submitted to Nature Photonics (if their paper proceeds to peer review). The checklist aims to encourage authors to standardize characterization as well as to provide information to aid referees.

As we push the boundaries of optics, reliable standards might not yet exist, they may be difficult to determine and the community takes time to adopt them. However, for the sake of clarity and rigor, let’s strive to establish them.
Further information

https://www.nature.com/authors/policies/availability.html

Standardizing the resolution claims for coherent microscopy
https://doi.org/10.1038/nphoton.2015.279

Tackling standardization in fluorescence molecular imaging
https://doi.org/10.1038/s41566-018-0221-5

Keeping up standards
https://doi.org/10.1038/s41566-018-0131-6