A solar cell includes a first electrode located over a substrate, at least one p-type semiconductor absorber layer located over the first electrode, the p-type semiconductor absorber layer comprising a copper indium selenide (CIS) based alloy material, an n-type semiconductor layer located over the p-type semiconductor absorber layer, an insulating aluminum oxide layer located over the n-type semiconductor layer, the insulating aluminum oxide having an aluminum content of 100 ppm to 5000 ppm and a second electrode over the insulating aluminum oxide layer, the second electrode being transparent and electrically conductive. The insulating aluminum oxide having an aluminum content of 100 ppm to 5000 ppm, may be deposited by pulsed DC, non-pulsed DC, or AC sputtering from an aluminum doped zinc oxide having an aluminum content of 100 ppm to 5000 ppm.
# INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

**H01L 31/042 (2006.01)**

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

- H01L 31/042, C23C 14/34, C04B 35/453

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

- Korean utility models and applications for utility models
- Japanese utility models and applications for utility models

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: i-ZnO, aluminum, doped

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>JP 07-258836 A (TOSOH CORP.) 09 October 1995 See paragraphs [0009]-[0010] and claim 1.</td>
<td>1-20, 22</td>
</tr>
<tr>
<td>A</td>
<td>R. OTTOSOON &quot;The role of i-ZnO for shunt prevention in Cu(In,Ga)Se2-based solar cells&quot;, Uppsala Universitet, 30 April 2006 See pages 14-15.</td>
<td>1-22</td>
</tr>
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Further documents are listed in the continuation of Box C.

See patent family annex.

- **A**: document defining the general state of the art which is not considered to be of particular relevance
- **E**: earlier application or patent but published on or after the international filing date
- **L**: document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
- **O**: document referring to an oral disclosure, use, exhibition or other means
- **P**: document published prior to the international filing date but later than the priority date claimed
- **T**: later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- **X**: document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- **Y**: document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- **&**: document member of the same patent family

Date of the actual completion of the international search: 19 OCTOBER 2010 (19.10.2010)

Date of mailing of the international search report: 19 OCTOBER 2010 (19.10.2010)

Authorized officer: KIM Min Soo

Telephone No.: 82-42-481-8249

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