Title: PHOTOACTIVE DEVICES AND COMPONENTS WITH ENHANCED EFFICIENCY

Abstract: Devices, compositions and methods for producing photoactive devices, systems and compositions that have improved conversion efficiencies relative to previously described devices, systems and compositions. This improved efficiency is generally obtained by one or both of improving the efficiency of light absorption into the photoactive component, and improving the efficiency of energy extraction from that active component.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC: H01L 31/00(2006.01)

USPC: 136/252,256,263
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)
U.S.: 136/252, 256, 263

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

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

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>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 5,296,045 A (Banerjee et al) 22 March 1994 (22.03.1994), entire document.</td>
<td>1-5</td>
</tr>
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<td></td>
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<td>1-7</td>
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<tr>
<td>Y</td>
<td>US 2004/0118448 A1 (Scher et al) 24 June 2004 (24.06.2004), entire document.</td>
<td>1, 2, 4, and 6-9</td>
</tr>
<tr>
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<td>3 and 5</td>
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<td>1-7</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent 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 another 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

"I" 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: 24 July 2007 (24.07.2007)
Date of mailing of the international search report: 24 SEP 2007

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Form PCT/ISA/210 (second sheet) (April 2005)
### INTERNATIONAL SEARCH REPORT

**International application No.**  
PCT/US05/41127

#### Box No. II  Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:

2.☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

#### Box No. III  Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
Please See Continuation Sheet

1.☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2.☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.

3.☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4.☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-9

**Remark on Protest**  
☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet(2)) (April 2005)
### C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-9, drawn to photoactive devices with elongated light path length and reflective back electrodes.

Group II, claim(s) 10-14 and 27-29, drawn to photoactive devices having boundary layers.

Group III, claim(s) 15-26, drawn to photoactive devices having a photoactive layer comprising donor, donor/acceptor, and acceptor sublayers.

Group IV, claim(s) 30-31, drawn to a method of providing a photoactive device, involving a transparent electrode having a conductive polymer.

Group V, claim(s) 32-36, drawn to transparent devices having two transparent electrodes.

The inventions listed as Groups I and (II-V) do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: None of Groups II-V requires the elongated path length and reflective back electrodes of Group I, and Group I requires none of the features listed above for Groups II-V.

The inventions listed as Groups II and (I or III-V) do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: None of Groups I and III-V requires the boundary layer of Group II, and Group II requires none of the features listed above for Groups I and III-V.

The inventions listed as Groups III and (I, II, IV, or V) do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: None of Groups I, II, IV, and V requires sublayers of Group III, and Group III requires none of the features listed above for Groups I, II, IV, and V.

The inventions listed as Groups IV and (I-III or V) do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: None of Groups I-III and V requires the transparent electrode having a conductive polymer of Group IV, and Group IV requires none of the features listed above for Groups I-III and V.

The inventions listed as Groups V and (I-IV) do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: None of Groups I-IV require the two transparent electrodes of Group V, and Group V requires none of the features listed above for Groups I-IV.