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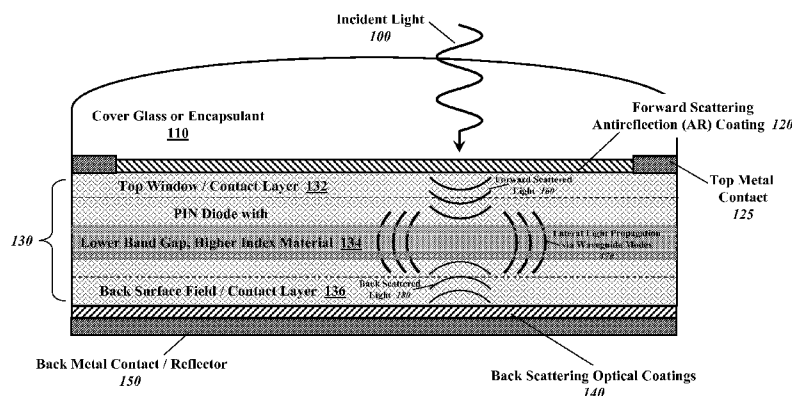


FIG. 1

(57) Abstract: A material structure and device design are provided that produce efficient photovoltaic power conversion. Materials of different energy gap are combined in the depletion region of a semiconductor junction. A wider energy gap barrier layer is positioned to reduce the diode dark current by suppressing both carrier injection across the junction and recombination rates within the junction. Light guiding layers are placed above and below the active region of the device in order to enhance optical absorption in the lower energy gap material.



INTERNATIONAL SEARCH REPORT

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ADD.

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

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 practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	THOMAS N D TIBBITS ET AL: "Efficiency Enhancement of Single Junction GAAS Solar Cells using Strain-Balanced Quantum Well Structures Under Concentration", CONFERENCE RECORD OF THE 2006 IEEE 4TH WORLD CONFERENCE ON PHOTOVOLTAIC ENERGY CONVERSION (IEEE CAT. NO.06CH37747),, 1 May 2006 (2006-05-01), pages 861-864, XP031007442, ISBN: 978-1-4244-0016-4 abstract; figures 2,3,4 subsection "Cell growth and design" subsection "Anti-reflection coatings" ----- -/--	1-15, 26-30



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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/020513

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	T.V. TORCHYNSKA; G.P. POLUPAN: "III-V material solar cells for space application", SEMICONDUCTOR PHYSICS, QUANTUM ELECTRONICS & OPTOELECTRONICS, vol. 5, no. 1, 2002, pages 63-70, XP009156236,	16-19, 22-25
A	abstract; figures 1,2,3 page 64 - page 65 -----	11
X	CHENG Y ET AL: "Diffused quantum well solar cells", MICROELECTRONICS AND VLSI, 1995. TENCON '95., IEEE REGION 10 INTERNATIONAL CONFERENCE ON HONG KONG 6-10 NOV. 1995, NEW YORK, NY, USA, IEEE, US, 6 November 1995 (1995-11-06), pages 81-84, XP010160051, DOI: 10.1109/TENCON.1995.496341 ISBN: 978-0-7803-2624-8	16-19, 22-25
A	abstract; figures 1,2 page 81 -----	11
A	WO 2009/120983 A2 (RENSSELAER POLYTECH INST [US]; CHHAJED SAMEER [US]; KIM JONG KYU [US];) 1 October 2009 (2009-10-01) the whole document -----	2,3,6-8, 17,22, 23,28
A	J.-Q. XI ET AL: "Omnidirectional reflector using nanoporous SiO ₂ as a low-refractive-index material", OPTICS LETTERS, vol. 30, no. 12, 1 January 2005 (2005-01-01), page 1518, XP55018329, ISSN: 0146-9592, DOI: 10.1364/OL.30.001518 the whole document -----	2,3,6-8, 17,22, 23,28
A	C. O. MCPHEETERS ET AL: "Improved performance of In(Ga)As/GaAs quantum dot solar cells via light scattering by nanoparticles", JOURNAL OF APPLIED PHYSICS, vol. 106, no. 5, 1 January 2009 (2009-01-01), page 056101, XP55017857, ISSN: 0021-8979, DOI: 10.1063/1.3213366 abstract; figure 1 pages 056101-1 - pages 056101-2 ----- -/--	4,5,9, 10,14, 15,25

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DERKACS D ET AL: "Nanoparticle-induced light scattering for improved performance of quantum-well solar cells", APPLIED PHYSICS LETTERS, AIP, AMERICAN INSTITUTE OF PHYSICS, MELVILLE, NY, US, vol. 93, no. 9, 3 September 2008 (2008-09-03), pages 91107-91107, XP012113729, ISSN: 0003-6951, DOI: 10.1063/1.2973988 abstract; figure 1 pages 091107-1 - pages 091107-2 -----	4,5,9,10
A	OKADA Y ET AL: "Fabrication of potentially modulated multi-quantum well solar cells", CONFERENCE RECORD OF THE THIRTY-FIRST IEEE PHOTOVOLTAIC SPECIALIST CONFERENCE (IEEE CAT. NO. 05CH37608) IEEE PISCATAWAY, NJ, USA,, 3 January 2005 (2005-01-03), pages 591-594, XP010822778, DOI: 10.1109/PVSC.2005.1488200 ISBN: 978-0-7803-8707-2 abstract; figures 1,2 -----	18,19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
W0 2009120983 A2	01-10-2009	US 2011120554 A1	26-05-2011
		W0 2009120983 A2	01-10-2009
