



- (51) **International Patent Classification:**  
G02F 1/00 (2006.01)
- (21) **International Application Number:**  
PCT/US201 1/0445 12
- (22) **International Filing Date:**  
19 July 201 1 (19.07.201 1)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
61/399,889 19 July 2010 (19.07.2010) US
- (71) **Applicant (for all designated States except US):** RENS-  
SELAER POLYTECHNIC INSTITUTE [US/US]; Of-  
fice of Technology Commercialization, 110 8th Street,  
Troy, NY 12180 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** LIN, Shawn-Yu  
[US/US]; 4041 Windsor Drive, Niskayuna, NY 12309  
(US). KIM, Yong Sung [KR/US]; 9 Eva Street, Latham,  
NY 12110 (US). HSIEH, Mei-Li [US/US]; 285 Sunset  
Terrace A-12, Troy, NY 12180 (US).
- (74) **Agent:** FALATI, Shahrokh; Heslin Rothenberg Farley &  
Mesiti P.C., 5 Columbia Circle, Albany, NY 12203 (US).

(81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— with international search report (Art. 21(3))

(88) **Date of publication of the international search report:**  
20 March 2014

(54) **Title:** INTEGRATED POLARIZED LIGHT EMITTING DIODE WITH A BUILT-IN ROTATOR

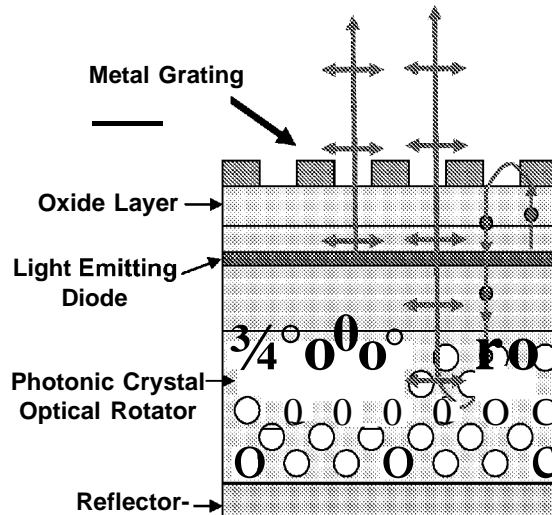


FIGURE 1

(57) **Abstract:** The invention is directed to an integrated polarized light emitting diode device that has a light emitting diode, a metal grating, an oxide layer, and a built-in photonic crystal rotator. Additional teachings include a method for making the integrated polarized light emitting diode, a method for improving the polarization selectivity and energy efficiency of a light emitting diode, and a method for rotating polarization of a light emitting diode.



**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US2011/044512

<p>A. CLASSIFICATION OF SUBJECT MATTER  <b>IPC(8) - G02F 1/00 (201 1.01)</b>  <b>USPC - 359/256</b></p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>																			
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols)                  IPC(8) - G02B26/08; G02F1/00, G02F 1/03, G02F 1/07, G02F 1/09, G02F 1/29; H01L 33/00 (201 1.01)                  USPC - 257/98; 359/251, 359/256, 359/280, 359/281, 359/301, 359/324</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)                  MicroPatent, Google Patents, Google Scholar</p>																			
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:10%;">Category*</th> <th style="width:70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width:20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 2004/0080805 A1 (LEVY) 29 April 2004 (29.04.2004) entire document</td> <td>1, 4-7, 9</td> </tr> <tr> <td>Y</td> <td></td> <td>2-3, 8, 10-32</td> </tr> <tr> <td>Y</td> <td>US 2010/0133504 A1 (WANG et al) 03 June 2010 (03.06.2010) entire document</td> <td>2-3,8,10-32</td> </tr> <tr> <td>A</td> <td>US 2010/0150513 A1 (ZHANG et al) 17 June 2010 (17.06.2010) entire document</td> <td>1-32</td> </tr> <tr> <td>A</td> <td>US 2005/0088084 A1 (COK) 28 April 2005 (28.04.2005) entire document</td> <td>1-32</td> </tr> </tbody> </table>		Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2004/0080805 A1 (LEVY) 29 April 2004 (29.04.2004) entire document	1, 4-7, 9	Y		2-3, 8, 10-32	Y	US 2010/0133504 A1 (WANG et al) 03 June 2010 (03.06.2010) entire document	2-3,8,10-32	A	US 2010/0150513 A1 (ZHANG et al) 17 June 2010 (17.06.2010) entire document	1-32	A	US 2005/0088084 A1 (COK) 28 April 2005 (28.04.2005) entire document	1-32
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																	
X	US 2004/0080805 A1 (LEVY) 29 April 2004 (29.04.2004) entire document	1, 4-7, 9																	
Y		2-3, 8, 10-32																	
Y	US 2010/0133504 A1 (WANG et al) 03 June 2010 (03.06.2010) entire document	2-3,8,10-32																	
A	US 2010/0150513 A1 (ZHANG et al) 17 June 2010 (17.06.2010) entire document	1-32																	
A	US 2005/0088084 A1 (COK) 28 April 2005 (28.04.2005) entire document	1-32																	
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/></p>																			
<p>* Special categories of cited documents:</p> <table style="width:100%;"> <tr> <td style="width:50%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width:50%;"> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table>		<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>																
<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>																		
<p>Date of the actual completion of the international search</p> <p>04 November 2011</p>	<p>Date of mailing of the international search report</p> <p align="center"><b>25 NOV 2011</b></p>																		
<p>Name and mailing address of the ISA/US</p> <p>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents                  P.O. Box 1450, Alexandria, Virginia 22313-1450                  Facsimile No. 571-273-3201</p>	<p>Authorized officer:</p> <p align="center">Blaine R. Copenheaver</p> <p>PCT Helpdesk: 571-272-4300                  PCT OSP: 571-272-7774</p>																		