

(12) **United States Patent**
Nielson et al.

(10) **Patent No.:** **US 9,126,392 B1**
(45) **Date of Patent:** **Sep. 8, 2015**

(54) **PHOTOVOLTAIC SOLAR CONCENTRATOR**

(75) Inventors: **Gregory N. Nielson**, Albuquerque, NM (US); **Jose Luis Cruz-Campa**, Albuquerque, NM (US); **Murat Okandan**, Edgewood, NM (US); **Paul J. Resnick**, Albuquerque, NM (US); **Carlos Anthony Sanchez**, Belen, NM (US); **Peggy J. Clews**, Tijeras, NM (US); **Vipin P. Gupta**, Reno, NV (US)

(73) Assignee: **Sandia Corporation**, Albuquerque, NM (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 943 days.

(21) Appl. No.: **13/240,520**

(22) Filed: **Sep. 22, 2011**

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/957,082, filed on Nov. 30, 2010, now Pat. No. 8,329,503, which is a continuation-in-part of application No. 11/933,458, filed on Nov. 1, 2007.

(51) **Int. Cl.**
B29C 65/02 (2006.01)
B32B 37/18 (2006.01)
B32B 37/26 (2006.01)
B32B 38/10 (2006.01)
H01L 21/00 (2006.01)
H01L 21/683 (2006.01)
B29C 65/74 (2006.01)

(52) **U.S. Cl.**
CPC **B32B 38/10** (2013.01); **H01L 21/6835** (2013.01)

(58) **Field of Classification Search**
CPC Y02E 10/50; Y02E 10/544; Y02E 10/542; Y02E 10/548; H01G 9/2031; H01L 31/048;

H01L 25/00; H01L 21/6835; B82Y 10/00; G09F 3/10; B32B 37/06; B32B 37/12; B32B 38/10; Y10T 156/1052; Y10T 156/1168
USPC 136/243, 252; 156/247, 249, 272.2, 156/273.3, 243, 252, 248, 250, 289
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,375,141 A 3/1968 Julius
4,089,705 A 5/1978 Rubin
4,149,665 A * 4/1979 Frosch et al. 228/5.1

(Continued)

OTHER PUBLICATIONS

English translation of JP11-068133; Matsushita et al. Sep. 3, 1999.*
(Continued)

Primary Examiner — Sonya Mazumdar

(74) *Attorney, Agent, or Firm* — Martin I. Finston

(57) **ABSTRACT**

A process including forming a photovoltaic solar cell on a substrate, the photovoltaic solar cell comprising an anchor positioned between the photovoltaic solar cell and the substrate to suspend the photovoltaic solar cell from the substrate. A surface of the photovoltaic solar cell opposite the substrate is attached to a receiving substrate. The receiving substrate may be bonded to the photovoltaic solar cell using an adhesive force or a metal connecting member. The photovoltaic solar cell is then detached from the substrate by lifting the receiving substrate having the photovoltaic solar cell attached thereto and severing the anchor connecting the photovoltaic solar cell to the substrate. Depending upon the type of receiving substrate used, the photovoltaic solar cell may be removed from the receiving substrate or remain on the receiving substrate for use in the final product.

19 Claims, 15 Drawing Sheets

