US009640698B2

(12) **United States Patent**
Dutta

(10) **Patent No.: US 9,640,698 B2**
(45) **Date of Patent: May 2, 2017**

(54) **ENERGY HARVESTING DEVICES AND METHOD OF FABRICATION THEREOF**

(71) Applicant: **Banpil Photonics, Inc.**, Santa Clara, CA (US)

(72) Inventor: **Achyut Dutta**, Sunnyvale, CA (US)

(73) Assignee: **BANPIL PHOTONICS, INC.**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 497 days.

(21) Appl. No.: **13/831,840**

(22) Filed: **Mar. 15, 2013**

(65) **Prior Publication Data**

US 2014/0261649 A1 Sep. 18, 2014

(51) **Int. Cl.**

H01L 31/076	(2012.01)
H01L 31/0224	(2006.01)
H01L 31/0352	(2006.01)
H01L 31/0687	(2012.01)
H01L 31/18	(2006.01)

(52) **U.S. Cl.**

CPC ***H01L 31/076*** (2013.01); ***H01L 31/022441*** (2013.01); ***H01L 31/03529*** (2013.01); ***H01L 31/0687*** (2013.01); ***H01L 31/1828*** (2013.01); *Y02E 10/543* (2013.01); *Y02E 10/544* (2013.01)

(58) **Field of Classification Search**

CPC H01L 31/076; H01L 31/022441; H01L 31/03529; H01L 31/1828; H01L 31/0687

USPC 136/260

See application file for complete search history.

(56) **References Cited**

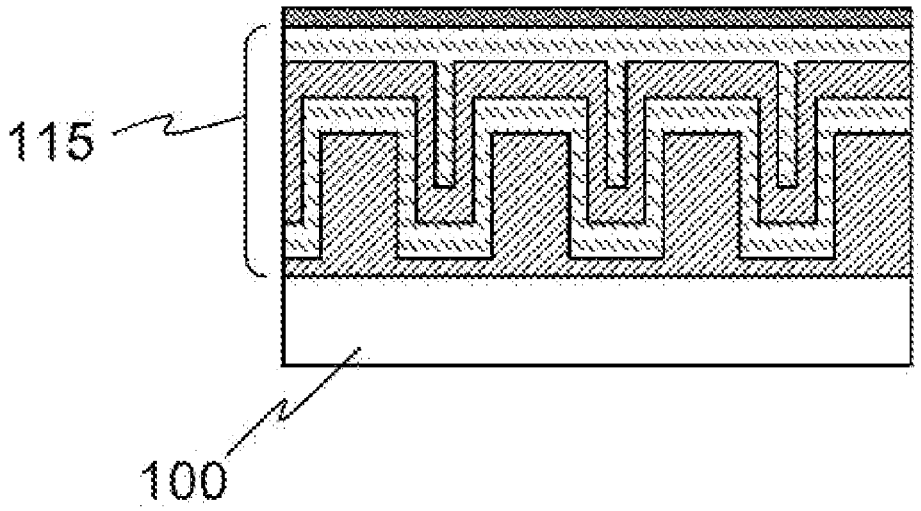
U.S. PATENT DOCUMENTS

2012/0073638 A1* 3/2012 Zhang H01L 31/02966 136/255

* cited by examiner

Primary Examiner — Jayne Mershon

(57) **ABSTRACT**

An apparatus and method pertaining to a perpetual energy harvester. The harvester absorbs ambient infrared radiation and provides continual power regardless of the environment. The device seeks to harvest the largely overlooked black-body radiation through use of a semiconductor thermal harvester.

20 Claims, 6 Drawing Sheets