

7-26-2016

Metallic layer-by-layer photonic crystals for linearly-polarized thermal emission and thermophotovoltaic device including same

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Recommended Citation

Lee, Jae-Hwang; Ho, Kai-Ming; and Constant, Kristen P., "Metallic layer-by-layer photonic crystals for linearly-polarized thermal emission and thermophotovoltaic device including same" (2016). *Iowa State University Patents*. 327.
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(12) **United States Patent**
Lee et al.

(10) **Patent No.:** US 9,400,219 B2
(45) **Date of Patent:** Jul. 26, 2016

(54) **METALLIC LAYER-BY-LAYER PHOTONIC CRYSTALS FOR LINEARLY-POLARIZED THERMAL EMISSION AND THERMOPHOTOVOLTAIC DEVICE INCLUDING SAME**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1098 days.

(21) Appl. No.: **12/754,657**

(22) Filed: **Apr. 6, 2010**

(65) **Prior Publication Data**
US 2010/0294325 A1 Nov. 25, 2010

Related U.S. Application Data

(60) Provisional application No. 61/179,468, filed on May 19, 2009.

(51) **Int. Cl.**
H01L 35/02 (2006.01)
G01J 5/52 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC **G01J 5/522** (2013.01); **G01J 3/108** (2013.01); **H02S 10/30** (2014.12)

(58) **Field of Classification Search**
CPC G01J 3/108; G01J 5/522; H02S 10/30
USPC 136/253
See application file for complete search history.

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(57) **ABSTRACT**

Metallic thermal emitters consisting of two layers of differently structured nickel gratings on a homogeneous nickel layer are fabricated by soft lithography and studied for polarized thermal radiation. A thermal emitter in combination with a sub-wavelength grating shows a high extinction ratio, with a maximum value close to 5, in a wide mid-infrared range from 3.2 to 7.8 μm , as well as high emissivity up to 0.65 at a wavelength of 3.7 μm . All measurements show good agreement with theoretical predictions. Numerical simulations reveal that a high electric field exists within the localized air space surrounded by the gratings and the intensified electric field is only observed for the polarizations perpendicular to the top sub-wavelength grating. This result suggests how the emissivity of a metal can be selectively enhanced at a certain range of wavelengths for a given polarization.

12 Claims, 5 Drawing Sheets

