Tohoku Univ. Technology

Photoelectric conversion device (Optical rectenna)

The antenna captures light and extracts it as power
—Enables photoelectric conversion of MIR&FIR—

Overview

Rectenna composed of an antenna and a diode is known as a device for converting electromagnetic waves into electric power. The rectenna absorbs electromagnetic waves with an antenna and performs photoelectric conversion. In recent years, research on optical rectennas, in which rectenna technology is applied to the optical frequency domain, has been advanced, and results of photovoltaic power generation have been reported. However, the optical rectennas reported at present are difficult to manufacture or have low efficiency.
The present invention has succeeded in significantly increasing the photoelectric conversion efficiency by introducing a special structure and material into the metal-dielectric-metal (MIM) tunnel diode and established an device based on hollow resonators.

Product Application

Energy harvesting is expected from mid- and far-infrared light, sun light, thermal radiation, human bodies, electronic devices, etc.

IP Data

IP No. : (JP)2020-003738
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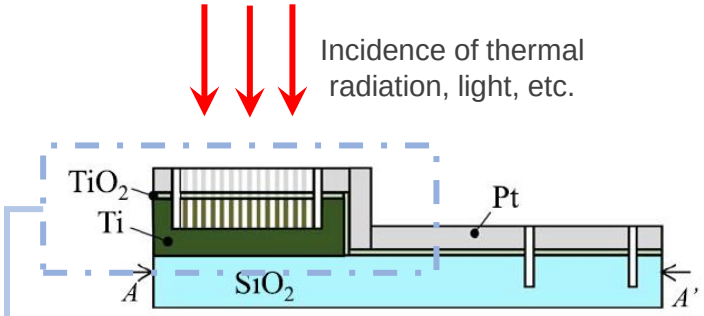
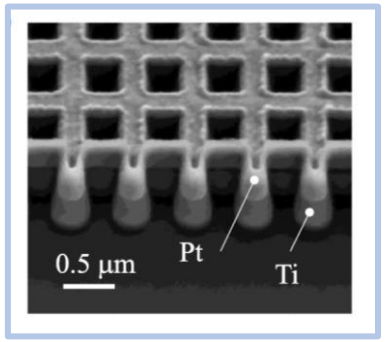
Admin No : T19-437

Features・Outstandings



Example of prototype device structure



MIM structure of the diode of the present invention

・10 -160 times higher short-circuit current density than previously reported

・Achieved a short-circuit current density of 2.9 A/m² for 532 nm laser light (world's highest level)

・2.3 A/m² achieved at AM 1.5 *

*Power density of sunlight entering the earth's surface as it passes through the air layer at mid-latitudes

Related Works

[1] D.Matsuura, M. Shimizu, H. Yugami, *Sci.Rep.*,**9** (2019)

[2] D.Matsuura, M. Shimizu, Zhen Liu, H. Yugami, *Appl. Express* **15** 062001(2022)

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