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Accession number:12743578
Title:Fabrication and Characterization of New Ti-TiO₂-Al and Ti-TiO₂-Pt Tunnel Diodes
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Source title:Active & Passive Electronic Components
Abbreviated source title:Act. Passiv. Electron. Compon. (USA)
Publication date:2012
Pages:694105 (6 pp.)
Language:English
ISSN:0882-7516
Document type:Journal article (JA)
Publisher:Hindawi Publishing Corporation
Country of publication:USA
Material Identity Number:GE23-2012-001
Abstract:Remotely empowered wireless sensor networks use different energy resources including photovoltaic solar cells, wireless power transmission, and batteries. As another option the electromagnetic energy available in the ambient can be harvested to power these remote sensors. This is particularly valuable if it is desirable to harvest the ambient energy available in the wide range of electromagnetic spectrum. This has motivated the research for developing energy harvesting devices which can absorb this energy and produce a DC voltage. Rectenna, an antenna coupled with a rectifier, is the main component used for absorbing electromagnetic radiation at GHz and THz frequencies. Rectifying MIM tunnel diodes are able to operate at tens and hundreds of GHz frequency. As the preliminary steps towards development of high-frequency rectifiers, this paper presents fabrication and DC characterization of two new MIM diodes, Ti-TiO₂-Al and Ti-TiO₂-Pt. G-V analysis of the fabricated diodes verifies tunneling. Brinkman-Dynes-Rowell model is used to extract oxide thickness of which the derived value is around 9 nm. Ti-TiO₂-Pt diode exhibits rectification ratio of 15 at 0.495 V, which is more than rectification ratio reported in earlier works.
Number of references:17
Inspec controlled terms:aluminium - electromagnetic wave absorption - energy harvesting - energy resources - MIM devices - platinum - rectennas - rectifiers - titanium - titanium compounds - tunnel diodes - wireless sensor networks
Uncontrolled terms:remotely empowered wireless sensor network - energy resource - photovoltaic solar cell - wireless power transmission - battery - electromagnetic energy harvesting device - electromagnetic spectrum - DC voltage production - rectenna - electromagnetic radiation absorption - rectifying MIM tunnel diode - G-V analysis - Brinkman-Dynes-Rowell model - voltage 0.495 V - Ti-TiO₂-Al - Ti-TiO₂-Pt
Inspec classification codes:B2560H Junction and barrier diodes - B5210 Electromagnetic wave propagation - B1210 Power electronics, supply and supervisory circuits - B7230 Sensing devices and transducers - B5270B Single antennas
Numerical data indexing:voltage 4.95E-01 V
Chemical indexing:Ti-TiO2-Al/int TiO2/int O2/int Al/int Ti/int O/int TiO2/bin O2/bin Ti/bin O/bin

Al/el Ti/el;Ti-TiO2-Pt/int TiO2/int O2/int Pt/int Ti/int O/int TiO2/bin O2/bin Ti/bin O/bin Pt/el Ti/el

Treatment:Practical (PRA)

Discipline:Electrical/Electronic engineering (B)

DOI:10.1155/2012/694105

Database:Inspec

IPC Code:H01L29/00; H01Q; H02M; H02N2/18