Beyond Photovoltaics: Nanoscale Rectenna for Conversion of Solar and Thermal Energy to Electricity

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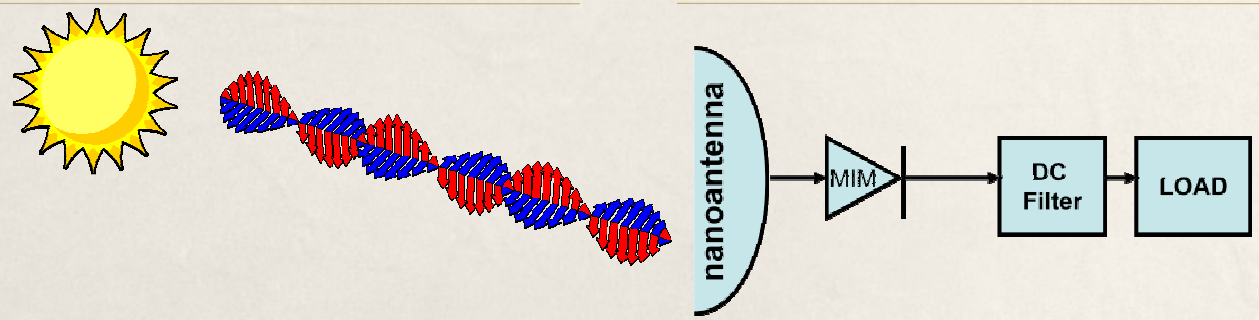
Objective

Develop a thermal energy conversion device operating in the Infrared regime



* Approach: These devices are developed based on the concept known as **RECTENNA (RECtifying anTENNA)**.
* Rectenna comprises of an antenna and a tunnel junction whose frequency can be scaled depending on its application.
* This presentation discusses about the manufacturing aspects of different rectenna elements.

CERC Clean Energy Research Center

FESC Florida Energy Systems Consortium

USF UNIVERSITY OF SOUTH FLORIDA

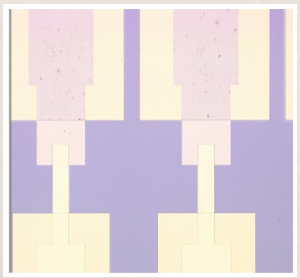
Development of MIM Tunnel Junction

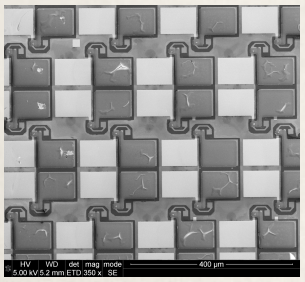
Inorganic Tunnel Junction

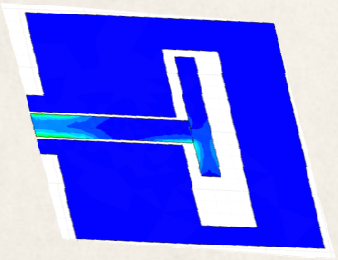
* Ni-NiO-Cr based MIM junction have been fabricated using optical lithography.
* The insulator layer was characterized and evaluated at different deposition conditions.
* NiO deposited with 25% O2 concentration yielded the optimum electrical response.

Organic Tunnel Junction

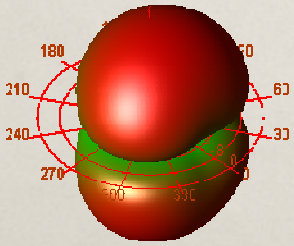
* Organic MIM junctions have been fabricated using E-beam lithography with Au-SAM-Cr.
* The thickness of the SAM layer was determined experimentally.
* The electrical response of the SAM-MIM were comparable to inorganic MIM's.







Design and Simulation of High Frequency Antenna



* A slot-fed dipole antenna has been developed to operate at 94 GHz
* A Co-Planar Waveguide feeding mechanism was used.
* A return loss of -36dB was achieved with 12GHz of bandwidth.
* The 94GHz antenna demonstrated a donut shaped radiation pattern with resonance at the center frequency.