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Design and simulation of optical Rectenna for high conversion efficiency

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Solar energy is abundant source of free energy available on the earth planet which is converted to any other form of energy according to the requirement. One of the conversions methods from solar to electrical is solar cells or photo voltaic where the photonic nature of sun light is converted into electrical energy with efficiency from 12% to 17%. Other than the photonic nature of the sun light, it also carries the electromagnetic EM nature with Tera Hertz (THz) frequency. Since the frequency of sun EM wave is very high therefore a very small (nano meter) antenna is required to receive the THz signal and convert into DC electrical energy. An antenna-coupled diode for optical frequency operation called optical rectenna incorporates a Nano antenna and an ultra-high-speed diode. The optical rectenna absorbs electromagnetic radiation and converts it to current. A diode rectifies the AC current, providing DC electrical power. Compared with conventional Si based solar cells, which absorb photons and generate electron-hole pairs to provide electrical power, rectennas based on Maxwell's electromagnetic wave theory of light.

Currently investigated optical rectennas using metal/insulator/metal (MIM) diodes are limited in their RC response time and poor impedance matching between diodes and antennas. A new rectifier, the geometric diode, can overcome these limitations but due to conductive thin film geometric diode have some reverse leakage current issues which will reduce its efficiency. Our work has been to design a package which containing electron-hole transporting layers with conductive layer which are connected with Nano-antennas. In our research work we are proposing an idea of removing the diode from the optical rectenna circuit because up till now no ultrafast diode is present which have efficiency more than 10%, it limitize the efficiency of optical rectenna. We also proposed the improved fabrication processes for optical rectenna circuit which can be used for mass production.