Proceedings of the 9th International Symposium on Radiative Transfer, RAD-19
June 3-7, 2019, Athens, Greece

RAD-19 NS04

NEAR-FIELD THERMOPHOTOVOLTAIC CONVERSION BY EXCITATION OF MAGNETIC POLARITON WITH NANOSTRUCTURED DRUDE EMITTERS

Payam Sabbaghi,[1] Yue Yang,[1,2] Jui-Yung Chang,[1,3] and Liping Wang[1,*]

[1] School for Engineering of Matter, Transport, and Energy
Arizona State University, Tempe, AZ, 85287, USA
[2] School of Mechanical Engineering and Automation,
Harbin Institute of Technology (Shenzhen), Shenzhen, 518055, China
[3] Department of Mechanical Engineering,
National Chiao Tung University, Hsinchu, 30010, Taiwan

ABSTRACT. In this work, we study the effect of magnetic polariton (MP) on the conversion performance of a near-field thermophotovoltaic (TPV) system made of a nanostructured Drude grating emitter and a nanometer-thick photovoltaic (PV) cell with a lossless metal as the back reflector. It is theoretically shown that MP can be excited inside the nanometric vacuum gap and the 100-nm PV cell to spectrally enhance the heat flux above the cell bandgap. It is found that the conversion efficiency reaches from 0.7% to 12.2% when the semi-infinite InGaSb cell is replaced by an ultra-thin PV cell supported by a back reflector with the emitter temperature at 1000 K and $In_{0.18}Ga_{0.82}Sb$ cell at 300 K separated by 200 nm. The conversion efficiency can be also further improved to 17.6% using a nanostructured Drude grating emitter over a planar emitter.