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# Impact of Magnetic Properties on Selective Emitters metamaterial for Low Band-Gap Thermophotovoltaic Applications.

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Abstract
Nonrenewable fossil fuels are the primary source of energy used globally. In this study, we have designed a broadband, wide-angle, and polarization-independent grating metamaterial (MDM) emitter for thermophotovoltaics (TPV), which falls under the category of renewable energy. The electronic and optical properties of materials, model metamaterial structures, and simulate their optical properties using DFT and FEM approaches were analyzed. The designed emitter utilizes a cutoff wavelength of 2.7 μm to enhance the conversion efficiency of InGaAsSb cells. We also examined the impact of magnetic properties on the selective emitter. We found that the material's magnetic properties affect and become a cause for broadband emittance capacity. The simulations demonstrated a mean emittance of 94% within the wavelength range of 0.3–2.7 μm were obtained. Compared to other emitters, the proposed design exhibits superior spectral efficiency for the InGaAsSb cell. Additionally, at 800 K, the grating emitter achieved 76% spectral efficiency for an InGaAsSb bandgap of 0.46 eV. Surface plasmon polaritons, magnetic polaritons, and intrinsic InMnAs exhibit strong absorption at the cutoff wavelength. The key advantages of this work include high average emittance, polarization insensitivity, simple fabrication, cost efficiency and excellent spectral performance.
Keywords: Selective Emitter, Energy, Thermo photovoltaic, Magnetic-Metamaterial

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