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High Temperature Optimized W-HfO_2 Thermal Emitters for Thermophotovoltaic Applications GERARDO SILVA, PATRICK FAY, University of Notre Dame, CARLOS JEREZ, Pontificia Universidad Catlica de Chile — Thermophotovoltaic cells are a promising way to efficiently convert thermal radiation, e.g. from waste heat or other source, into electricity. To improve efficiency, use of "selective emitters" that reshape the emitted electromagnetic spectrum are an attractive option. We explore the incorporation of hafnia (HfO_2) layers into two easy-to-fabricate tungsten (W) structures via rigorous coupled wave analysis. HfO_2 and W are well-suited to high temperature operation, and the high permittivity of HfO_2 enhance performance. The emittance is analyzed for metal-insulator-metal multilayer structures and one-dimensional gratings. By using a genetic algorithm with a suitable cost function and constraints, optimum geometrical parameters are found. We show that these structures exhibit very high thermal emittance, reaching normal in-band emittances higher than 90% for both cases, with weak dependence on incidence angle. Explanations of the emittance enhancement are given through simulations using the finite element method and by theoretical considerations. The proposed emitters are designed for a working temperature of approximately 1700 K, as needed for GaSb (0.72 eV) or InGaAs (0.74 eV) photovoltaic cells.

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