多層膜構造を用いた波長選択熱輻射構造

Wavelength Selective Thermal Emitters with Layered Structures

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Applications of radiative heat transfer often consider large areas, thus, layered structures are advantageous because layered structures are easy scale up. Thus, although our initial works on wavelength selective thermal emitters have adopted 2D nanostructures [1,2], here we present a layered structure which combines a metallic film and a distributed Bragg reflector (DBR) to excite apparently cavity-less resonance mode, i.e. Tamm plasmon polariton (TPP) mode, as shown in Fig. 1 [3,4]. Interestingly, our fabricated samples show high Q-factors (~30) in the emissivites which are nearly twice higher than most of the metamaterial emitters studied in the past. Our latest work demonstrates that the metallic film in the TPP structure can be replaced to a refractory ceramic; titanium nitride (TiN) [5]. Using TiN, the structure can sustain up to 1000 °C and 500 °C in vacuum and in air, respectively. Large-area wavelength selective thermal emitter can be used in infrared heaters and thermophotovoltaic systems.

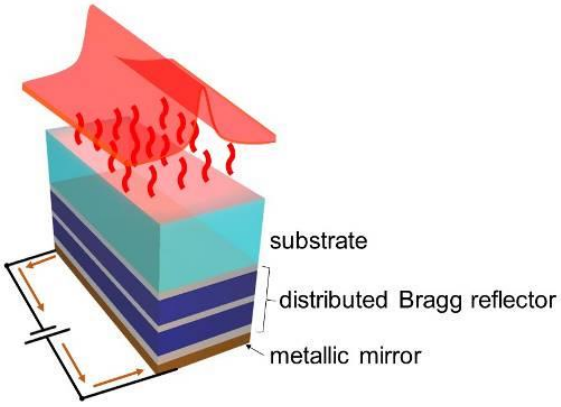

Figure 1. Schematic of a wavelength selective thermal emitter based on Tamm plasmon polaritons.

References

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