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Controlling incandescence using Metamaterials

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Xianliang Liu, Willie J. Padilla
Boston College
Talmage Tyler, Nan Marie Jokerst
Duke University
Tatiana Starr, Anthony F. Starr
SensorMetrix, Inc.

A blackbody is an idealized object that absorbs all radiation incidents upon it and reradiates energy solely determined by its temperature, as described by Planck's law. The phenomenon that material emits light at high temperature is also known as incandescence. The desire to control incandescence has long been a research topic of interest for scientists—one particular theme being the construction of a selective emitter whose thermal radiation is much narrower than that of a blackbody at the same temperature. In this work we demonstrate, for the first time, selective thermal emitters based on metamaterial perfect absorbers. We experimentally realize a narrow band mid-infrared (MIR) thermal emitter. Multiple metamaterial sub-lattices further permit construction of a dual-band MIR emitter. By performing both emissivity and absorptivity measurements, we find that emissivity and absorptivity agree very well as predicted by Kirchhoff's law of thermal radiation. Our results directly demonstrate the great flexibility of metamaterials for tailoring blackbody emission.

Reference:

1, Liu, X. et al. Phys. Rev. Lett. 107, 045901 (2011).

Primary author: LIU, Xianliang (Boston College)

Presenter: LIU, Xianliang (Boston College)

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