

High Efficiency Incandescent Lighting

Technology #15367

Applications

This invention relates to a novel way of redesigning the incandescent light bulb using thermal emitter surfaces and multilayer optical filters to increase the operating efficiency.

Problem Addressed

Incandescent light bulbs are the most common source of everyday lighting. However, during the modern era, these light bulbs were not very efficient as only 2-5% of electrical power ended up in the visible spectrum. The remaining energy was wasted, mostly by radiation in the infra-red spectrum and some as heat loss. Given that 25% of generated electrical energy is used for lighting, more opportunities are sought out to save more power by moving to more energy efficient light sources.

Technology

The present technology consists of a thermal emitter coupled to a photonic filter designed to reflect infrared radiation, while offering near 100% transmission in the visible spectrum. It relies on a specific emitter-filter geometry that allows for efficient reabsorption of infrared light, significantly increasing the efficiency relative to standard incandescent bulbs.

The thermal emitter consists of a refractory metal (tantalum or tungsten) arranged in a winding square pattern; however, it can also be composed of other materials or include a photonic crystal on its surface to tailor thermal emission. The photonic filter can be a rugate filter, though other multilayer designs are possible. The fabricated filter consists of 48 layers of silicon dioxide and tantalum pentoxide, showing both theoretically and experimentally to offer strong reflection in the near-IR with strong transmission at visible wavelengths.

Advantages

- Dramatically better performance relative to current incandescent lighting systems: up to 7 times more efficient.
- Compared to standard incandescent lightbulbs, the redesigned bulb achieves the same operating temperature for a fraction of the wall-plug power (as little as 20%)

Categories For This Invention:

Energy

Energy Efficiency

Intellectual Property:

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