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11583

Patent(s) Issued

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# Structure and Method For Controlling The Thermal Emissivity of a Radiating Object

## SUMMARY

An important objective in the design of many familiar objects such as automobiles, machinery, buildings, electric power equipment, and military and space systems is to provide adequate means of dissipating the heat they generate. In the majority of engineered systems operating in the earth's atmosphere, heat transfer between a surface and its environment relies on conduction and convection more than radiation. Developed by researchers at PNNL, this invention called Structure and Method for Controlling the Thermal Emissivity of a Radiating Object uses microstructures to control the energy radiated from or to any surface or object. The concept offers passive and/or active control of the radiative properties of surfaces as an additional option in the thermal design of an object or system.

This method involves creating closely spaced micro-cavities known as micropits that either enhance or reduce heat emission and provide other advantageous surface properties to essentially any device or product. As a passive surface treatment, the micropit array enhances infrared (IR) emission because each cavity radiates as a nearly-perfect black-body emitter. However, in addition, each "thermal pixel" of the array (that may have an aperture as small as 100  $\mu\text{m}$ ) can be switched "on" or "off" by programmable microstructures that cap or expose individual cavities. By altering and/or switching the IR emissivity of surfaces between high and low values, advanced thermal control, programmable thermal camouflage (i.e., blending with a background) and remote IR identification schemes are possible.

## ADVANTAGES

Increases the usefulness of radiative heat transfer in the thermal design of objects or systems

Offers active control of heat radiation from any surface for a variety of engineering values

Has diverse application potential

Is scalable and effective from micrometer sizes and up

Changes IR signatures, which could be useful for example, in military and security applications

### Patents & Intellectual Property

- » Patent #: 6,713,774

### Technology Portfolio(s)

- » Energy Efficiency
- » Microtechnology
- » Microsystems

### Potential Industry Applications

- » Aerospace & Defense
- » Automotive & Transportation
- » Computers & Electronics
- » Energy & Utilities
- » Manufacturing & Warehousing
- » Public Administration & Government
- » Security

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