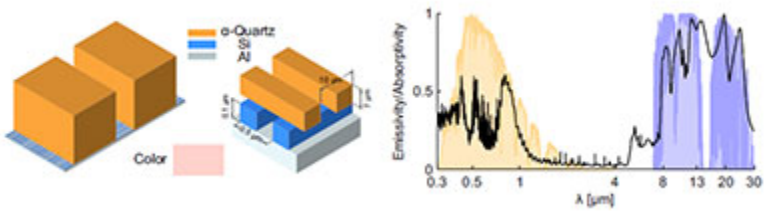
Docket #: S13-404

Color-preserving daytime radiative cooling

Researchers in Prof. Shanhui Fan's laboratory have developed a flexible, transparent, nanostructured material that enables daytime radiative cooling while preserving the color of the underlying substrate. This material is designed to be transparent at solar wavelengths while being highly emissive at thermal wavelength. This allows the whole structure to reach thermal equilibrium at a lower temperature than it would otherwise. This technology could be a powerful enabling tool for passive cooling in a variety of applications such as outdoor or technical clothing, automobiles, or outdoor electronic devices.



On the left is a schematic drawing of radiative cooling structure which includes a quartz bar array on top of silicon nanowires. On the right, the black curve shows the emissivity/absorptivity spectrum of the modified structure.

Stage of Research
The inventors have provided a concrete numerical implementation of this approach based on realistic three-dimensional simulations and real material parameters.

Applications

- **Textiles** - particularly for high performance athletic apparel or military clothing
- **Automobile materials**

- **Building materials** and other structures exposed to sunlight where maintaining a certain appearance is important (e.g. roof tiles)
- **Outdoor electronics** and other devices where passive cooling would reduce overheating that degrades performance

Advantages

- **Transparent material** - maintains color and appearance for aesthetic or functional purposes
- **Flexible** - can be applied to flexible substrate for a range of applications
- **Passive cooling** - no external energy is needed

Publications

- L. Zhu, A. Raman, S. Fan, "Color-preserving daytime radiative cooling". *Appl. Phys. Lett.* 103, 223902 (2013).

Patents

- Published Application: 20150131146
- Published Application: 20160268464

Innovators

- Shanhui Fan
- Aaswath Pattabhi Raman
- Linxiao Zhu
- Eden Rephaeli

Licensing Contact

Jon Gortat

Licensing & Strategic Alliances Director for Physical Science

Email