Docket #: S16-236

Ultrahigh Performance Radiative Cooler

Stanford researchers at the Fan Group have designed and tested a highly efficient radiative cooler prototype with the following record-breaking performance results:

- Temperature drop of 42 degrees Celsius (and theoretical drop of 60 degrees C) which approaches the fundamental limit on cooling
- Daytime performance surpassed previous record by almost an order of magnitude
- Nighttime performance, carried out in a populous area at sea level, significantly exceed previous record carried out at a mountain-top desert

This work demonstrates significant potential for radiative cooling, which can have practical impacts ranging from passive building cooling, renewable energy harvesting, and passive refrigeration in arid regions. ?

Figure

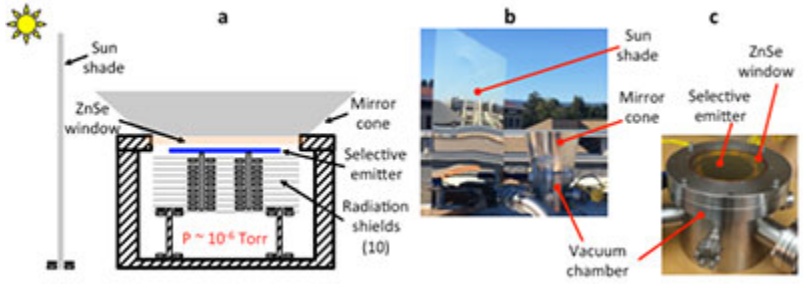


Figure description - Experimental concept. a) Schematic of the experimental setup. The key feature is to minimize parasitic heat losses of convection and air conduction using a vacuum system. Radiation shields and long hollow ceramic pegs are exploited to further reduce the radiation and conduction losses through the backside of the selective emitter. The shinny sun shade and mirror cone are used to minimize solar irradiation. ZnSe is selected for its transparency in the mid-infrared wavelength range. b) In-situ experimental setup. c) Details of the vacuum chamber, including the selective emitter and the ZnSe window.

Stage of Research

- Prototype performed with record breaking results
- Working on cooling power extraction

Applications

- **High-powered cooling for:**
  - Buildings
  - Automobiles
  - Freezers
  - Passive refrigeration in arid regions
- Possible source of renewable energy (by means of harnessing heat flow towards space)

Advantages

- Record breaking performance
- Can serve as a complement to existing cooling technology, e.g. air conditioning
- **Highly Effective-** Significantly exceeds previous maximum efficacy recorded for radiative cooling devices, approaching the fundamental limit for possible cooling
- **Environmentally-friendly-** Does not result in the emission of greenhouse gases
- **Economical:**
  - Radiative cooling is entirely passive and does not consume power
  - Uses thin film deposition that can be performed at large scales

Patents

- Published Application: 20180023866
- Issued: 10,508,838 (USA)

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