

Oxide multicalorics

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Cooling is essential for food, medicine, electronics and thermal comfort of people in houses and cars, but existing technologies for refrigeration and air-conditioning are based on the compression and expansion of gases that are harmful for the environment.

Cooling using solids is therefore attractive but thermoelectric cooling based on the Peltier effect, and optical cooling based on anti-Stokes fluorescence, are at best only ~10% efficient. By contrast, magnetocaloric, electrocaloric, and mechanocaloric cooling based on thermal changes produced in magnetically, electrically, and mechanically responsive oxides when subjected to changes in magnetic field, electric field and mechanical field promise higher efficiencies.

In this lecture, I will:

- describe the fundamentals of caloric oxides from a historical perspective
- give an overview of their measuring techniques
- present recent advances on magnetocaloric, electrocaloric and mechanocaloric oxides
- and describe recent developments on cooling devices that are based on these materials.