



Contribution ID: 72

Type: **Contributed Oral**

Barocaloric Materials –Cooling and Heat storage – Atomic Level Understanding with Neutrons

Wednesday 3 December 2025 11:15 (15 minutes)

Refrigeration is of vital importance for modern society—for example, for food storage and air conditioning—and 25 to 30 per cent of the world's electricity is consumed for refrigeration. Current refrigeration technology, mostly involving the conventional vapour compression cycle, is of growing environmental concern because of large amount of greenhouse gases released into atmosphere every year. As a promising alternative, refrigeration technologies based on solid-state caloric effects have been attracting attention for several decades. Searching for novel materials having large isothermal entropy changes upon phase transition induced by a small external field is the core activity in the study of solid-state caloric effects. To understand the mechanism of the large caloric effect and the associated phase transition is fundamentally important. In this presentation, I will discuss atomic-level understanding of the the colossal barocaloric effects (CBCEs) (large cooling effects induced by pressure) and inverse barocaloric effect (thermal battery for heat storage) of plastic crystals using inelastic and quasielastic neutron scattering [1-3].

[1] Bing Li, et al. *Nature*, 567, 506 (2019).

[2] Q Y Ren, et al. *Nature communications* 13, 2293 (2022).

[3] Z Zhang, et al. *Science Advance* 9, eadd0374 (2023).

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Session Classification: Condensed Matter & Materials

Track Classification: Topical Groups: Condensed Matter & Materials