

## Negative Thermal Expansion Materials

### Background

Thermal expansion can seriously degrade the performance of industrial systems and equipment by environmental temperature changes. Therefore, materials that contract on heating, or negative thermal expansion materials, are of great interest to industrial engineers. However, negative thermal expansion materials of practical use are rare.

### Technology Overview

A research group at Nagoya University has discovered a reduced ruthenate ceramic material, made up of calcium, ruthenium and oxygen atoms, that shrinks by a record-breaking 6.7% when heated. This is more than double the previous record for a negative thermal expansion material, and the bulk material expands again when it is cooled. In a wide industrial field, this new ceramic material can be used for improving the stability of device performance, and for prolonging device lifetime.

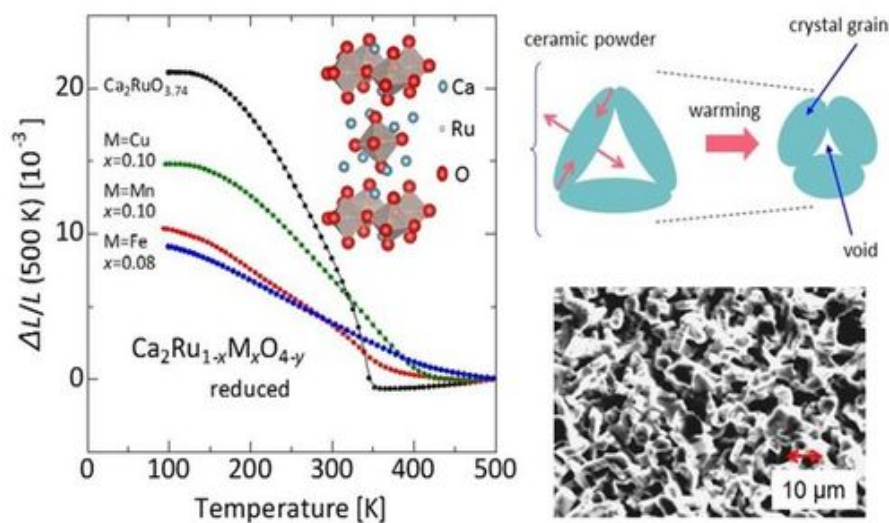


Figure 1. A layered ruthenate  $\text{Ca}_2\text{RuO}_{4-y}$  ceramic body contracts on heating, or exhibits negative thermal expansion (NTE). The sintered-body structure shows colossal NTE when extremely anisotropic thermal expansion of the crystal grains produces deformation, consuming open spaces (voids) on heating. The total volume change related to NTE reaches 6.7% at most, the largest reported so far.

### Further Details

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### State of Development

Sample distribution of materials is available.

### Seeking

Licensing

### IP Status

Patent application submitted

### Patents

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