

How shape-memory materials remember

April 26 2010

X-ray studies and fundamental calculations are helping physicists gain molecular level insight into the workings of some magnetic shape-memory materials, which change shape under the influence magnetic fields.

Shape-memory materials could potentially serve as light weight, compact alternatives to conventional motors and actuators. But developing practical devices will require creating materials that exhibit much larger changes in shape than most of the known shape-memory materials.

A paper appearing in the April 25 issue of [Physical Review Letters](#) reports on the efforts of a team of Japanese physicists who probed the changes in a magnetic shape-memory material at the molecular scale. The work is highlighted with a Viewpoint article by Antoni Planes (Universitat de Barcelona) in the April 25 edition of *APS Physics*.

The new research focused on a shape-memory alloy made up of nickel, manganese and tin. In its ideal form, the alloy is a crystal with each element occupying specific crystal locations relative to one another. In some versions, however, excess manganese atoms replace some of the tin atoms. Although the compositional change is slight, it can have significant effects on the alloy's behavior. X-ray [spectroscopy](#) allowed the researchers to observe the microscopic characteristics of the alloy to see precisely how the excess manganese atoms affect the alloy's behavior.

By studying the way that composition affects a shape-memory material,

and comparing measurements to [theoretical calculations](#), it will be possible to understand what makes the materials work, and allow physicists to develop new and improved varieties shape-changing metals.

More information: Role of Electronic Structure in the Martensitic Phase Transition of $\text{Ni}_2\text{Mn}_{1+x}\text{Sn}_{1-x}$ Studied by Hard-X-Ray Photoelectron Spectroscopy and Ab Initio Calculation, M. Ye, A. Kimura, Y. Miura, M. Shirai, Y. T. Cui, K. Shimada, H. Namatame, M. Taniguchi, S. Ueda, K. Kobayashi, R. Kainuma, T. Shishido, K. Fukushima, and T. Kanomata, Phys. Rev. Lett. 104, 176401 (2010) - Published April 26, 2010. [Download PDF](#) (free)

Provided by American Physical Society

Citation: How shape-memory materials remember (2010, April 26) retrieved 24 April 2024 from <https://phys.org/news/2010-04-shape-memory-materials.html>

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