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## Novel Alloy Changes Shape in Magnetic Field

**Huntingdon ... 7 June 2011 ...** Goodfellow, an international supplier of metals and materials for research and product design, has announced the availability of a magnetic shape memory alloy (nickel-manganese-gallium) that responds to magnetic fields as well as to temperature, allowing for the conversion of magnetic field energy into kinetic energy. Although it is similar in action to piezo-based or magnetostrictive materials, this patented NiMnGa single crystal produces much higher strain outputs (typically 10 to 100 times more) and higher energy density (8 to 50 times higher). This innovative alloy represents a significant alternative to conventional actuators, especially for applications that require a large strain and light weight, such as in aerospace, automotive and medical components.

### How it works in typical applications

#### Actuators

When placed in a magnetic field, the NiMnGa single crystal elongates by up to 6 percent. This response is faster and more efficient than a traditional temperature-induced response. The elongation is fully reversible (i.e., the original shape is “remembered”) when a magnetic field is applied at 90° to the original field or by the use of a return spring. The shape change is very rapid, with cycle times of up to 1 to 2 kHz observed and several hundred million cycles achieved while testing fatigue life.

#### Breaker switches/fuses

The additional thermal shape memory property of the material, whereby it elongates even further above 70°C, can be used as a safety cut-off. The actuator runs until the safe working temperature is reached, whereupon it extends further and cuts off the magnetic field generation. This additional elongation is fully reversible; below 70°C the actuator functions normally again.

## **Energy harvesters and vibration dampers**

Compressing or elongating this material causes it to alter any magnetic field in which it is placed, and this can be used to “harvest” vibration energy. Possible uses include battery charging in environments where it is difficult to gain access to the batteries for replacement. The same properties used to create energy harvesters can be used to damp mechanical vibration.

## **Sensors**

Using the material’s properties, it is possible to construct compact speed sensors as well as distance, strain and magnetic field detectors.

## **Optimum dimensions**

In order to minimize the magnetic energy required to elongate the material, a thin, wide cross-section is preferred, and as the elongation is a multiple of the length, a comparatively long strip is also preferred. Therefore, Goodfellow offers this material in the following standard dimensions. Other dimensions are of course available upon request.

1 mm thickness x 2.5 mm width x 20mm length

1 mm thickness x 5 mm width x 20mm length

2 mm thickness x 5 mm width x 20mm length

## **About Goodfellow**

For more than 40 years, the Goodfellow name has been synonymous with small quantities of high-quality metals, polymers, ceramics and other materials that meet the research, development, and specialised production requirements of science and industry worldwide. Goodfellow Cambridge Ltd. is part of the Goodfellow Group of Companies, which also includes The Technical Glass Company (UK), Goodfellow Corporation, Goodfellow SARL, Goodfellow GmbH, and the Shanghai Representative Office of Goodfellow Cambridge Ltd.

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