Superelastic iron alloy could be used for heart and brain surgery

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Shape memory alloys developed by the research group.

(PhysOrg.com) -- Scientists in Japan have designed an elastic iron-based shape metal alloy for use in applications as diverse as heart and brain surgery and buildings in earthquake-prone areas.

The researchers, from Tohoku University, said the ferrous polycrystalline shape memory alloy was as strong as high-strength industry alloys, but it is also superelastic, which means it can return to its

original form when strain is removed and the material is heated, an important property of all shape memory alloys. The iron alloy even returns to its former shape when under almost twice the strain levels endured by current shape memory alloys. The alloy also exhibits changes in ductility and a large reversible change in magnetization during shape transitions.

The alloy's stress level is around double that of the shape memory alloy nickel-titanium, which means it can be formed into extremely thin wire. At present the nickel-titanium alloy is the only superelastic alloy available for practical use. Superelastic properties make a shape memory alloy ideal for delivering stents to parts of the body such as the heart since they can expand to a wider diameter when warmed by the body. Stents are tubes that are surgically implanted into blood vessels to prevent them collapsing.

One of the engineers, T. Omori, said stents are currently delivered to the heart using nickel titanium wire, but its diameter is too thick to allow it to be used in the brain. The new iron alloy could be made thin enough to be used for brain stents.

Omori said the elastic iron alloy may have other uses, such as in buildings in earthquake zones where a material that is both strong and flexible is needed. The buildings are deformed during the earthquake, but the iron alloy's property of remembering and returning to its original form means the super-elastic alloy could return the building to its former shape. Other potential uses of superelastic alloys include blast protection, noise reduction, and vibration isolation.

The paper was published in the journal *Science* last Friday.

More information: Ferrous Polycrystalline Shape-Memory Alloy Showing Huge Superelasticity, *Science* 19 March 2010: Vol. 327. no.

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