A laser based manufactured SMA integrated device

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Shape Memory Alloys (SMAs) are a unique group of shape memory materials (SMMs) which can significantly alter their shape (to a pre-programmed, i.e. 'memorised' state). This change in state is triggered by exposure to a certain stimuli, in particular heating the material. A number of materials (both metal alloys and polymers) exhibit this effect, called the Shape Memory Effect (SME). The most well-known and commonly used SMA is nickel-titanium (Ni-Ti), often called NITINOL. The SME can be induced under high applied loads and can be used as the basis of high force, low volume actuators that are an attractive alternative to conventional actuators.

In recent years SMAs have gained significant traction in the biomedical field. Due to their compact designs, precise actuation and low energy consumption, they are ideal devices to solve actuation challenges in-vivo. Some examples include the 'Simon NITINOL Filter' and self-expanding stents [1].

Laser based manufacturing processes such as cutting, micro-machining and surface treatments can be used to manufacture complex 2-way actuation designs involving SMAs, often in conjunction with other materials.

The work presented in this talk focuses on a laser-based manufacturing of a mechanically bistable structure that is actuated by NITINOL SMA. This is designed to be used to operate a valve for control of fluid flow as part of an in-vivo biomedical device.

[1] Machado, L.G. and M. A. Savi. (2003) Medical applications of shape memory alloys, Brazilian journal of medical and biological research, 36, pp. 683-691.