

## Superelastic Nitinol – Laser welding case study

A nitinol tube is used in a superelastic stent application, where it expands and contracts at its distal end.

In this application, a 3mm diameter nitinol tube is cut to allow its entry through a 3.2mm port, where it expands to manipulate tissue inside the body. It is then retracted through the 3mm port.

From its earliest use in orthodontic arch wires to its more recent important role in cardiovascular implants such as stents, endografts, and filters, nitinol possesses unique properties that have made it the material of choice for a variety of medical applications. Nitinol's superelastic properties make it the material of choice here.

While conventional engineering materials typically have an elastic limit much less than 1% strain, nitinol can experience fully recoverable strains up to 8%. This capability allows a properly designed nitinol component to radically transform its shape during service lending itself to the flexibility needed in minimally invasive procedures. A nitinol stent for example may be designed to be delivered through a 2-mm sheath and expand to support a 10mm diameter blood vessel. Similarly, an endoscopic instrument may be delivered through a 15mm diameter instrument, expand to 60 mm to retrieve a specimen, and then collapse to exit through a similarly sized port.

If a medical component must be delivered in a compressed state and then become an expanded shape, nitinol is likely to offer design advantages unavailable with other materials.

Laser cutting allows removal of a portion of the nitinol tube to allow it to flex into a smaller diameter, or to expand itself to a larger diameter. A high power laser beam is focussed on or just below the surface to be cut, and metal is either melted or vaporised by the heat from the laser source. An assist gas accompanies the laser beam to the cutting position, and assists both in cutting and removal of molten metal. Cutting widths of typically 10-15 micro-metres are present. An intricate cut pattern can be obtained in the tube.

