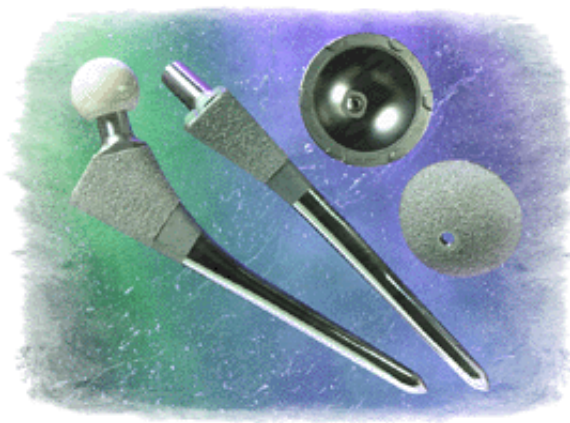


Applications for Shape Memory alloys

Shape Memory metals that were developed by NASA for the space industry, and have been used for increasing applications down on earth. The following is a list of just some of the applications that shape memory alloys have been used for.

Bioengineering:

❖ **Bones:** Broken bones can be mended with shape memory alloys. The alloy plate has a memory transfer temperature that is close to body temperature, and is attached to both ends of the broken bone. From body heat, the plate wants to contract and retain its original shape, therefore exerting a compression force on the broken bone at the place of fracture. After the bone has healed, the plate continues exerting the compressive force, and aids in strengthening during rehabilitation. Memory metals also apply to hip replacements, considering the high level of super-elasticity. The photo above shows a hip replacement.



❖ **Reinforcement for Arteries and Veins:** For clogged blood vessels, an alloy tube is crushed and inserted into the clogged veins. The memory metal has a memory transfer temperature close to body heat, so the memory metal expands to open the clogged arteries.

❖ **Dental wires:** used for braces and dental arch wires, memory alloys maintain their shape since they are at a constant temperature, and because of the super elasticity of the memory metal, the wires retain their original shape after stress has been applied and removed.

Anti-scalding protection: Temperature selection and control system for baths and showers. Memory metals can be designed to restrict water flow by reacting at different temperatures, which is important to prevent scalding. Memory metals will also let the water flow resume when it has cooled down to a certain temperature.

Fire security and Protection systems: Lines that carry highly flammable and toxic fluids and gases must have a great amount of control to prevent catastrophic events. Systems can be programmed with memory metals to immediately shut down in the presence of increased heat. This can greatly decrease devastating problems in industries that involve petrochemicals, semiconductors, pharmaceuticals, and large oil and gas boilers.

Golf Clubs: a new line of golf putters and wedges has been developed using _____. Shape memory alloys are

inserted into the golf clubs. These inserts are super elastic, which keep the ball on the clubface longer. As the ball comes into contact with the clubface, the insert experiences a change in metallurgical structure. The elasticity increases the spin on the ball, and gives the ball more "bite" as it hits the green.

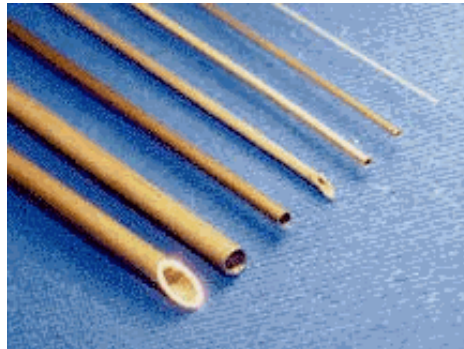
Helicopter blades: Performance for helicopter blades depend on vibrations; with memory metals in micro processing control tabs for the trailing ends of the blades, pilots can fly with increased precision.

Eyeglass Frames: In certain commercials, eyeglass companies demonstrate eyeglass frames that can be bent back and forth, and retain their shape. These frames are made from memory metals as well, and demonstrate super-elasticity.



The photo to the right demonstrates flexible eyewear.

Tubes, Wires, and Ribbons: For many applications that deal with a heated fluid flowing through tubes, or wire and ribbon applications where it is crucial for the alloys to maintain their shape in the midst of a heated environment, memory metals are ideal.



Different sizes of NiTiNol tubes

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