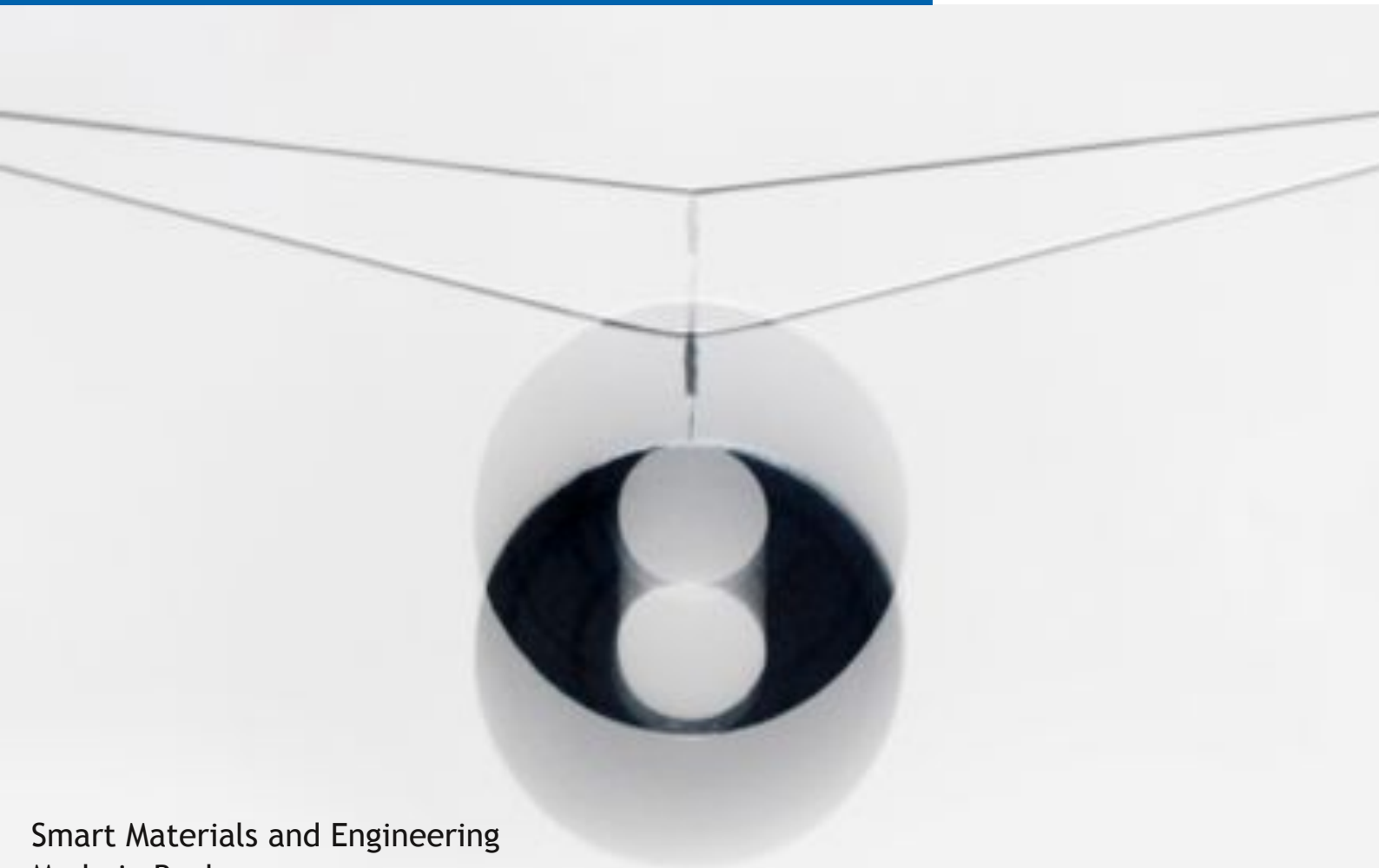


Shape Memory Alloys





FROM CAST TO COMPONENT!

HIGHEST PRODUCT QUALITY BY 100% VERTICAL INTEGRATION

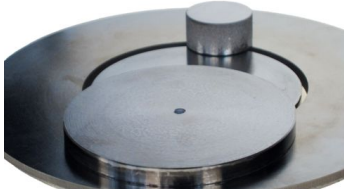
Shape Memory Alloys

Shape Memory alloys (SMA) are special metal materials which have the ability to restore their initial shape after a severe deformation, they "remember" it. Technically relevant are mainly NiTi-based SMAs, i.e. alloys consisting of Nickel and Titanium, also known as "Nitinol". Due to the functional properties of this material, it is a very suitable choice for actuator applications, but also parts which need to endure large reversible deformations (such as guide wires or catheters in biomedical applications). SMA combine actuator and sensor properties. With the highest energy density of all known actuator materials, they provide an enormous potential for weight reduction and energy efficiency. Pseudoelastic SMA can be deformed reversibly a hundred times more than conventional steels. NiTi-based actuators can lift up to a thousand times their own weight



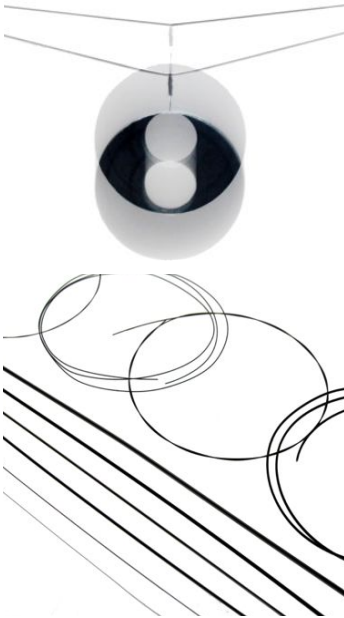
Cast Products

High purity Shape Memory ingots and experimental melts for research and development; binary, ternary and quaternary NiTi(X,Y)-FGL (X, Y = Cu, Fe, Cr, V, Hf, Nb, Co, Mo, Zr) .



NiTi(X,Y) Sputter Targets

Shape Memory Sputter Targets with customized alloy compositions and geometries for thin film applications.



Shape Memory Wires

Shape Memory wires provide highest actuator forces on small installation spaces. When actuator wires are heated above their transition temperature they remember their former shape after a certain deformation (tension, bending, torsion). By this effect they high forces and actuator strokes can be realized.

The portfolio of Ingpuls contains SMA wires with different properties - starting with binary NiTi-alloys, up to fatigue resistant and highstrength ternary and quaternary alloys. Beside standard alloys Ingpuls offers customized products, with transition temperature from -150 to 100°C that can be adapted to customers need by special alloying and processing. Additionally shape memory alloys from Ingpuls represent highest purities and improved properties in opposite to commercial available standard alloys.

Specifications

Alloys: NiTi, NiTiCu₅, NiTiCu₁₀

Diameter: 0,2 - 2 mm

Condition: cold drawn, heat treated, straight annealed

Surface: with or without oxydlayer



Superelastic Wires

Superelastic wires are very flexible, corrosion resistant and provide very good damping properties due to their stress induced transformation potential. The superelastic alloys from Ingpuls are conform with ASTM F2063-05 and considerably exceed purities requirements.

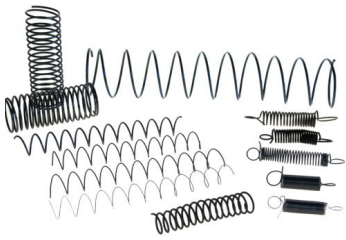
Specifications

Alloys: NiTi (ASTM F2063-05)

Diameter: 0,2 - 2 mm

Condition: cold drawn, straight annealed

Surface: with or without oxydlayer



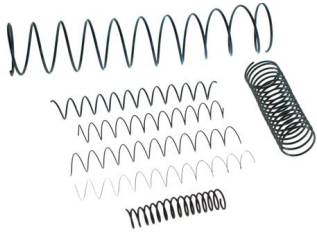
Shape Memory Actuator Springs

Shape Memory actuator springs can be used for different applications, where high strokes by moderate forces are required. Ingpuls manufactures customized SMA springs from standard and special alloy. The components can be designed appropriately to the operational and functional demands.

Specifications

Alloys: NiTi, NiTiCu₅, NiTiCu₁₀

Diameter: 0,25 - 2,0 mm



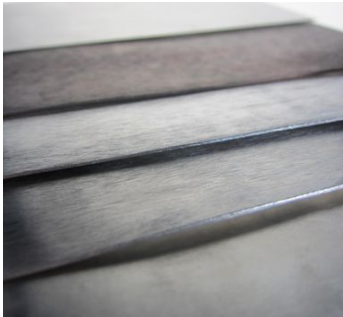
Superelastic Springs

Superelastic springs are suitable as bias springs with graded, customized and adaptive load deflection curves.

Specifications

Alloys: NiTi (ASTM F2063-05)

Diameter: 0,2 - 2,0 mm



Actuator Sheets and Strips

SMA sheet components are predominantly used as compact stroke actuators for valve applications. SMA sheets supports with highest actuator forces by moderate strokes on smallest installation space. Ingpuls manufactures customized sheet or strip actuator from standard and customized alloys. The components can be designed to the customers need to fulfill the applications requirements .

Specifications

Alloys: NiTi, NiTiCu₅, NiTiCu₁₀, NiTiCuCr, NiTiCuV, NiTiCuHf

Sheet thickness: 0,75 - 2 mm



Superelastic Sheets and Strips

Ingpuls manufactures superelastic sheets conform to ASTM F2063-05 and customized requirements. Superelastic sheets can be used for solid body joints, damping elements or adaptive clearance compensation.

Specifications

Alloys: NiTi (ASTM F2063-05)

Sheet thickness: 0,75 - 2 mm



Shape Memory Alloys for Medical Applications

Ingpuls manufactures superelastic components (wire, sheet, strips) conform to ASTM F2063-05 for the use in medical applications. These alloys exceed general requirements and obtain higher purities and mechanical properties than standard commercial available materials.



Individual Shape Memory Actuators

For new products and applications Ingpuls develops individual actuator elements, with customized properties. Actuator forces, strokes as well as fatigue properties are optimized to certain applications. On demand Ingpuls supports with fundamental SMA know-how by the engineering and product development process of our customers.



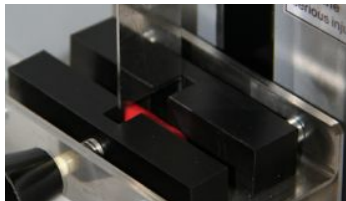
Individual Shape Memory Alloys

For most industrial applications standard Shape Memory alloys can not be used to fulfill customers needs. Mechanical properties, phase transformation temperatures and fatigue properties have to be carefully adapted. In such cases Ingpuls design new individual alloys that have tailored property characteristics.



EMS - Electronic Management System for SMA Actuator Systems

The compact electronic management system (EMS) provides a comfortable and reliable use of SMA actuators. The EMS avoids overheating and controls the actuation of the shape memory component carefully. Furthermore EMS allows realtime system diagnosis. Beside adaptive current feed the system allows for digital, discrete or continuous position controlling of the actuator component. The EMS aids the applicant to reduce and minimize the effort to integrate SMA actuator in technical systems.



Testing Devices for SMA Components and Products

The testing of new developed products and actuators based on shape memory alloys requires customized solutions. Ingpuls develops special testing devices, that can be used in the product development process and to ensure quality. The test devices are adjusted to the special SMA properties and can be either operated by Ingpuls or by our customers.



Shape Memory Technology Introduction-Set

The Shape Memory technology introduction-set contains several superelastic and actuator elements. It provides the applicant, without certain knowlegde an easy introduction in the field of shape memory technology. An additional information brochure gives a brief overview about the technological background of shape memory alloys and allows for first hands-on experience.



Shape Memory Alloys Training Course / In-House Training

The complex property characteristics of Shape Memory alloys complicates design and engineering of products with shape memory components. A fundamental knowlegde of production, processing and operating performance is necessary for a successful development. Ingpuls SMA experts qualify engineers and developer by a one day applicants seminar. They present recent information about fundamentals, applications and design.

Further information, application examples or movies
about Shape Memory alloys on:
www.youtube.com/ingpuls
www.facebook.com/ingpuls



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