SmartFlex®

Shape Memory Alloy Actuators

SmartFlex® is SAES Getters’ product line of shape memory alloy semi-continued shapes and components. Shape memory alloys are distinctive because they can undergo a shape change upon heating. Traditional shape memory alloys are typically used in applications where a material needs to change shape in response to a specific stimulus, such as temperature. SmartFlex® actuators offer the following advantages:

- **Reliability**
- **Compactness and flexibility**
- **Reduced cost**
- **Direct linear or angular movement**
- **Noiseless operation**
- **Compatibility with harsh environments**
- **No EMI**

SmartFlex® actuator wires deliver state-of-the-art performance for reliable actuators. They are suitable for a wide range of applications, including industrial and biomedical devices.

**HIGHLIGHTS**

- In-house vertically integrated process, from ingot to shape memory component manufacturing
- 100% on-line actuator wires quality control (patent pending)
- Full flexibility in product mix
- Know-how on shape memory component implementation in final devices
- Dedicated R&D SMA department
- ISO 14001 certified company – for SMA components, quality management system conforming to ISO TS 16949:2002 standard

**Industrial Applications**

- Thermal and electrical actuators
- Sensors/actuators for air conditioners
- Fire protection
- Antiscald safety valves
- Circuit breakers
- Damping and vibration control devices

**Biomedical Applications**

- Orthodontics
- Surgical tools
- Guidewires
- Implantable devices
- Orthopedics

**SAES® Group and Shape Memory Alloys**

The SAES Group, headquartered in Italy near Milan, is a leading supplier of advanced material solutions for scientific and industrial applications worldwide. SAES manufactures and sells metal alloy based active components for high-tech industrial applications.

Continuous forefront research and innovation activities, joint developments with customers, high volume manufacturing capabilities and a worldwide sales and service network have been driving the Group's success over the last sixty years.

By leveraging the core competence in special metallurgy and with the support of its affiliated company Memory-Metalle GmbH, SAES Getters offers a highly diversified product portfolio of shape memory alloy (SMA) semi-continued shapes and components, serving any need around industrial and biomedical applications.

The SAES Group manufacturing companies are ISO 9001 certified and the Italian companies are also ISO 14001 certified. Full information about certifications for each company of the Group are available on the corporate website at: www.saesgroup.com

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SmartFlex®

Shape Memory Alloy Actuators

SmartFlex® is SAES Getters' product line of shape memory alloy semi-finished shapes and components. Shape memory alloys' unique property to recover shape upon heating can be effectively packaged into compact, light, silent, and powerful actuators to replace alternative technologies based on wax, DC motors, and electrical motors. The unmatched energy density, degree of integration, and simplicity in design make shape memory alloys the new industry standard for linear and rotary actuators.

SMA actuators offer a full range of advantages:

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- Compactness and flexibility
- Reduced cost
- Direct linear or angular movement
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Industrial Applications

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- Circuit breakers
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- Eyewear

Biomedical Applications

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SAES Group
www.saes-group.com
sma@saes-group.com
SmartFlex Product Portfolio

- Alloy compositions: Shape memory and Superelastic (standard As –25 °C < T < 120 °C)
- Thermomechanical conditions: Cold-worked, Straight annealed, Shape annealed

Shapes:
- Round wire (25 µm ÷ 5 mm)
- Ribbon and strip (50 x 25 µm ÷ 10 x 0,76 mm)
- Thin sheet (down to 20 µm thickness and 100 mm width)

Springs

Surface finish:
- Electropolished, Shiny black oxide, Amber/brown oxide, Ultra-fine polished

SAES’ proprietary production route, involving a vertical integrated manufacturing process from Ni and Ti materials to final components, enables complete process control and flexibility in product mix.

For shape memory component manufacturing, SAES Getters is committed to adopting the quality management system conforming to ISO TS 16949:2002 standard.

SmartFlex Actuator Wires

- Wire thickness: 20 µm < d < 500 µm
- Maximum stroke: 5.5%
- Force @ 150 MPa: from 5 to 3,000 g
- Number of cycles: > 200,000 (at 150 MPa, 3.5% stroke)
- Transition temperatures (at 200 MPa load):
  - As > 90 °C
  - Af > 65 °C

Availability of wires with electrical crimps

Availability of NiTi wire in silicon sleeve

Advantages of SMA Actuators

SAES’ SmartFlex shape memory alloy wires have been specifically developed for actuator applications.

For linear movements of a few millimeters or angular movements of just a few degrees, use of a motor rotating at thousands of rpm coupled with gears, clutches and reducers is certainly not the best solution.

Replacement of small motors or solenoids can be effectively done with SmartFlex actuator wires. Since shape memory alloy wires present a very high specific working density, a number of new products and improved designs on existing products can be developed.

Use of “smart materials” for actuation represents a technological opportunity for development of electro-mechanical components: the typical characteristic of shape memory alloy wires of obtaining mechanical actions if stimulated with electrical current promotes development of simple, very compact, reliable actuators.

Component makers can use SMA materials to simplify products, add new functions, upgrade performance, improve reliability and cut down component costs, while significantly reducing mechanical complexity and size.

SmartFlex 100 µm wire
SmartFlex Product Portfolio

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- Availability of wires with electrical crimps
- Availability of NiTi wire in silicon sleeve

For light, powerful, reliable actuators,

Advantages of SMA Actuators
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For linear movements of a few millimeters or angular movements of just a few degrees, the use of a motor rotating at thousands of rpm coupled with gears, clutches and reducers is certainly not the best solution. Replacement of small motors or solenoids can be effectively done with SmartFlex actuator wires. Since shape memory alloy wires present a very high specific working density, a number of new products and improved designs on existing products can be developed.

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SmartFlex 100 µm wire

Advantages of SMA Actuation

- New developments of shape memory alloy wires have been specifically developed for actuators.
- For linear movements of few millimeters or angular movements of just a few degrees, the use of a motor rotating at thousands of rpm coupled with gears, clutches and reducers is certainly not the best solution.
- Replacement of small motors or solenoids can be effectively done with SmartFlex actuator wires. Since shape memory alloy wires present a very high specific working density, a number of new products and improved designs on existing products can be developed.
- Use of “smart materials” for actuation represents a technological opportunity for development of electro-mechanical components: the typical characteristic of shape memory alloy wires of obtaining mechanical actions if stimulated with electrical current promotes development of simple, very compact, reliable actuators.
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Shape Memory Alloy Actuators

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**Industrial Applications**

- Thermal and electrical actuators
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- Circuit breakers
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- Eyewear

**Biomedical Applications**

- Orthodontics
- Surgical tools
- Guidewires
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**SAES® Getters Group**

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SmartFlex® is SAES Getters’ product line of shape memory alloy semi-finished shapes and components. Shape memory alloys have the unique property to recover shape upon heating, which can be effectively packaged into compact, light-weight, and silent actuators for various applications. This results in unmatched energy density, size, magnetism, and simplicity. A single heat treatment can transform a simple shape into a versatile actuator.

Actuators offer a wide range of advantages:
- Reliability
- Compactness and flexibility
- Reduced cost
- Direct linear or angular movement
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- 100% on-line actuator wires quality control (patent pending)
- Full flexibility in product mix
- Know-how on shape memory component implementation in final devices
- Dedicated R&D SMA department
- ISO 14001 certified company - for SMA components, quality management system conforming to ISO/TS 16949:2002 standard
- Actuator wire mass production for high-volume industrial applications

Industrial Applications
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