

Staff Training – Edibon International S.A., Madrid, Spain, 04-06 September 2024

Reverse Engineering and Smart Materials

*Adam PATALAS,
adam.patalas@put.poznan.pl
Poznan University of Technology*

*Paweł Zawadzki,
pawel.zawadzki@put.poznan.pl
Poznan University of Technology*

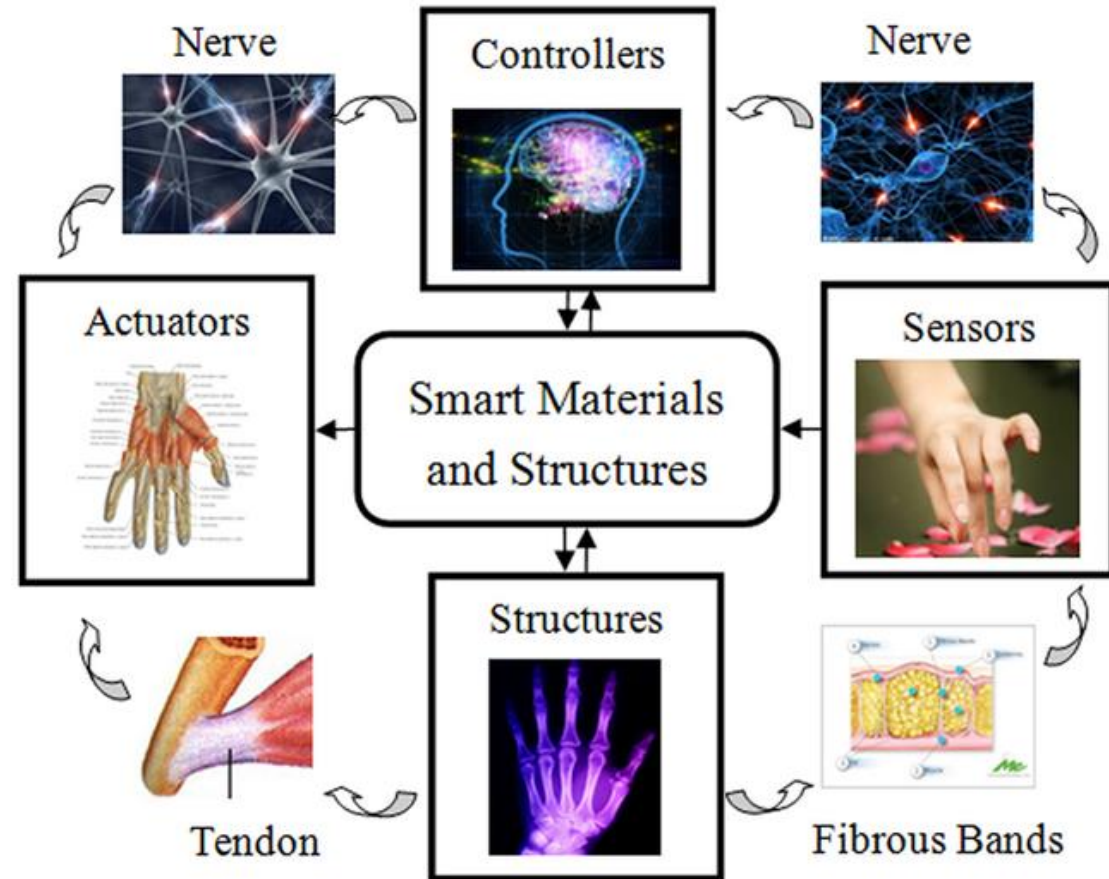


Staff Training – Multiplier Event, 04 November 2024

AGENDA

- 1. PUT AMAZE Team***
- 2. Introduction to Smart Materials***
- 3. Smart (Intelligent) Materials – e-Toolkit***

IO4 - EMERALD e-toolkit for
industrial design for
complex parts
**SMART (INTELLIGENT)
MATERIALS**

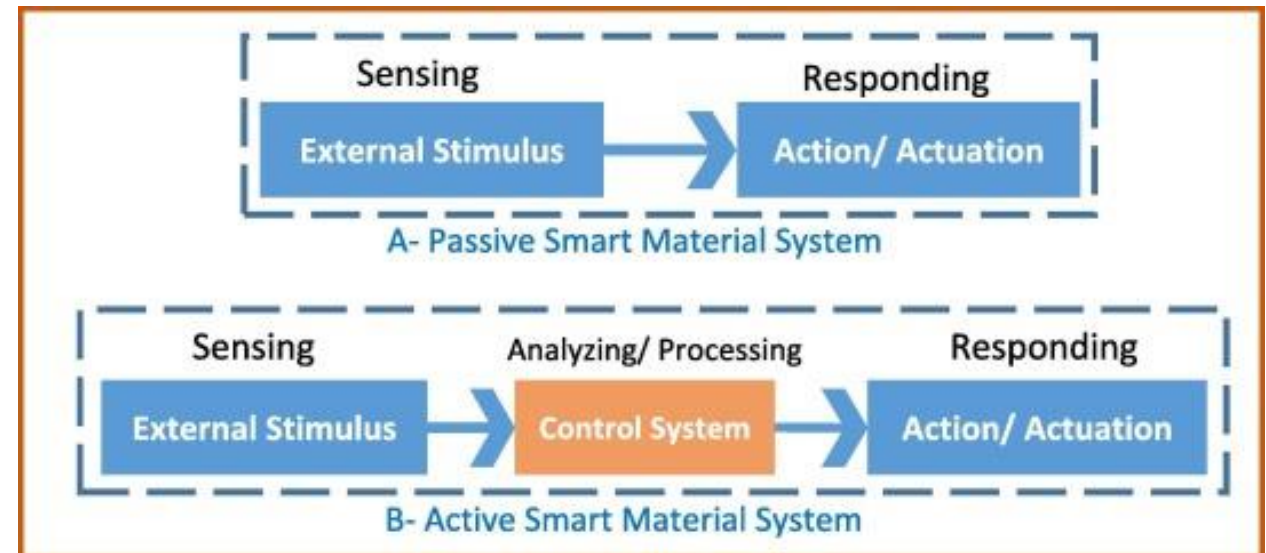


2. Introduction to Smart Materials

Smart materials, also called intelligent or responsive materials, are designed materials that have one or more properties that can be significantly changed in a controlled fashion by external stimuli, such as stress, moisture, electric or magnetic fields, light, temperature, pH, or chemical compounds. Smart materials are the basis of many applications, including sensors and actuators, or artificial muscles, particularly as electroactive polymers (EAPs).

we can divide them according to the effect of stimulation

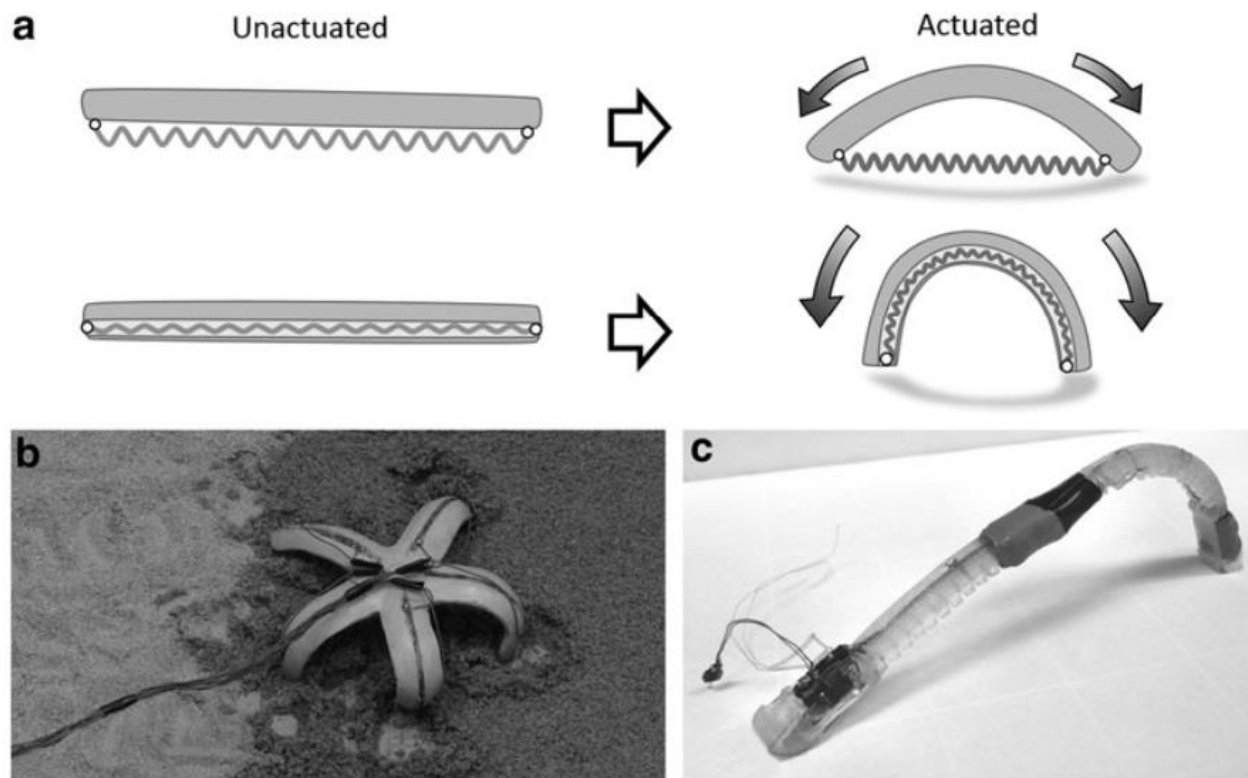
- Piezoelectric materials
- Shape-memory alloys and shape-memory polymers
- Photovoltaic materials or optoelectronics.
- Electroactive polymers
- Magnetostrictive materials
- Magnetic shape memory





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European Union

Erasmus+ Programme Key Action 2 Cooperation Partnerships
for Higher Education (KA220-HED)
Agreement number 2023-1-RO01-KA220-HED-000155412
European Network for Additive Manufacturing in Industrial Design for Ukrainian Context
Poznan, POLAND, November 4th, 2024



Shape Memory Alloys (SMAs)

(a) Comparison of SMA element attached at both ends of the actuator and located outside versus inside, (b) starfish-like soft robot with flexible rays actuated by SMA spring located within the structure, and (c) spring-driven robot with a silicone polymer body (Huai-Ti and Trimmer)

Rodrigue et al.,
2022



3.1 Experiment with SMAs

In prepared E-Toolkit, an experiment was described to create a spring using Nitinol—a material known for its shape memory properties. Nitinol is an alloy of nickel and titanium that can "remember" a specific shape and return to it when heated. Through this process, a programming procedure can be carried out that allows to creation of a spring that returns to its original form after being deformed. This experiment not only demonstrates the unique characteristics of Nitinol but also helps to understand how phase transformations can influence the material's mechanical properties.



Fig. Fragments of Nitinol wire prepared to experiment

3.2 Process of preparing SMAs



Forming

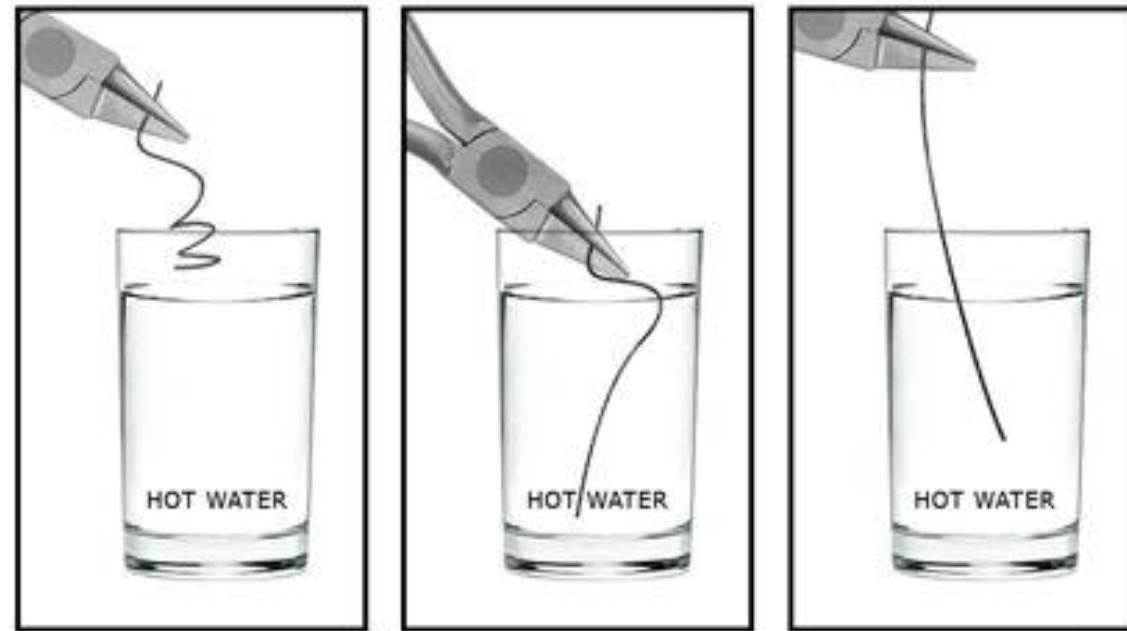


Heating



Fast cooling

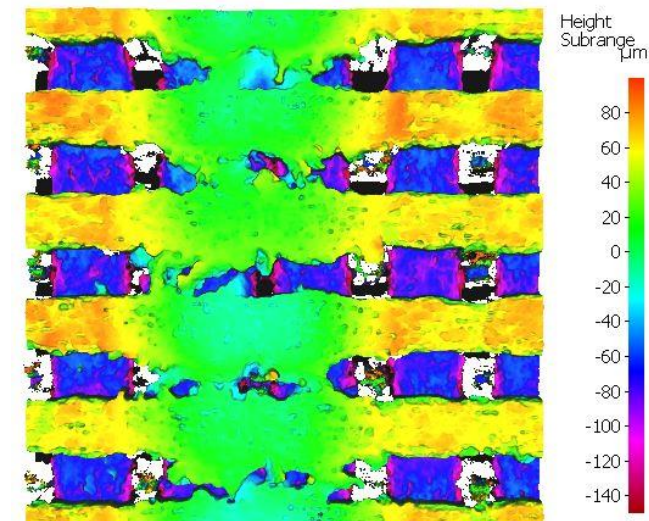
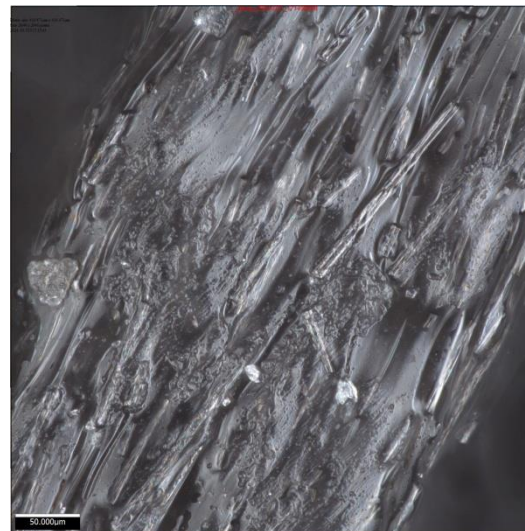
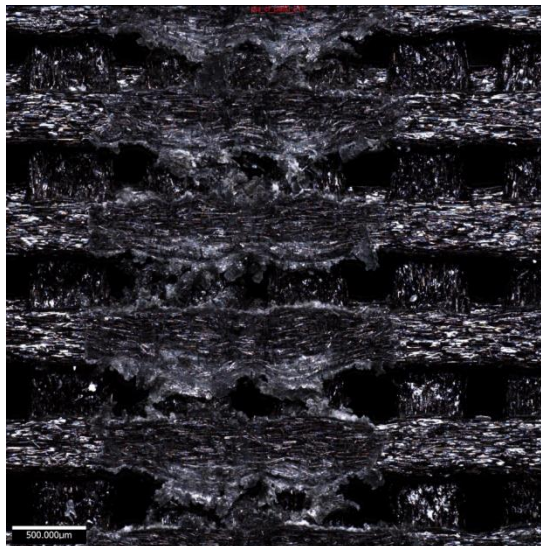
3.3 Testing properties of SMAs



Testing a shape memory of a Nitinol wire

3.4 Article in preparation

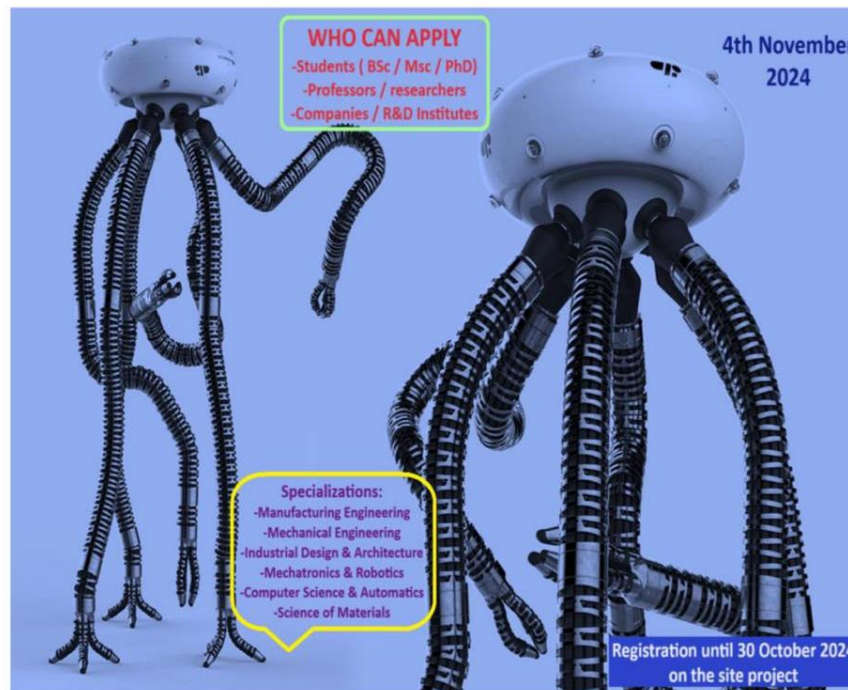
Study of the Influence of FDM Printing Parameters on the Tribological Properties of the Surface Layer of Carbon Fiber Reinforced PLA



Examples of results achieved in the study

AMAZE Multiplier Event 4 (ME 4) on:

Experiencing of e-learning platform for Additive Manufacturing in Industrial Design



WHO CAN APPLY

- Students (BSc / Msc / PhD)
- Professors / researchers
- Companies / R&D Institutes

Specializations:

- Manufacturing Engineering
- Mechanical Engineering
- Industrial Design & Architecture
- Mechatronics & Robotics
- Computer Science & Automatics
- Science of Materials

4th November
2024

Registration until 30 October 2024
on the site project

THANK YOU FOR YOUR
ATTENTION 😊