Interamerican University of Puerto Rico

Ponce Campus

Chem Demo Experiments

American Chemical Society Inter Ponce

1. Nitinol

Nitinol is an alloy which is 55% nickel and 45% titanium. This alloy is interesting because it can remember its shape. When a nitinol item is heated, the atoms in it “remember” their position, and so, on repeated heating they try to recover their original shape. If a nitinol item is deformed and then heated, the atoms take their initial position, and the shape of the item is restored. The state by which these materials recover their shape is the result of the solid-solid phase transformation between two material structures, that is, austenite and martensite. In this type of transformation we have a high temperature phase called austenite. If we cool the material, its structure changes and passes to a structure of lamellae, extremely interwoven and arranged in alternating cuts, called martensite.

These properties make it a material capable of recovering a predetermined shape after having suffered a macroscopic deformation, and can also be elastically deformed up to 8-10%.This process of transformation of the material is the basis of the two fundamental properties of this alloy: remembering its shape and superelasticity. The property of superstructurality implies that in both states the material is highly malleable.

The NiTi presents all the typical properties in alloys with shape memory:

• Thermoelastic martensitic transformation.

• Memory in a simple way.

• Memory of double form.

• Superelasticity.

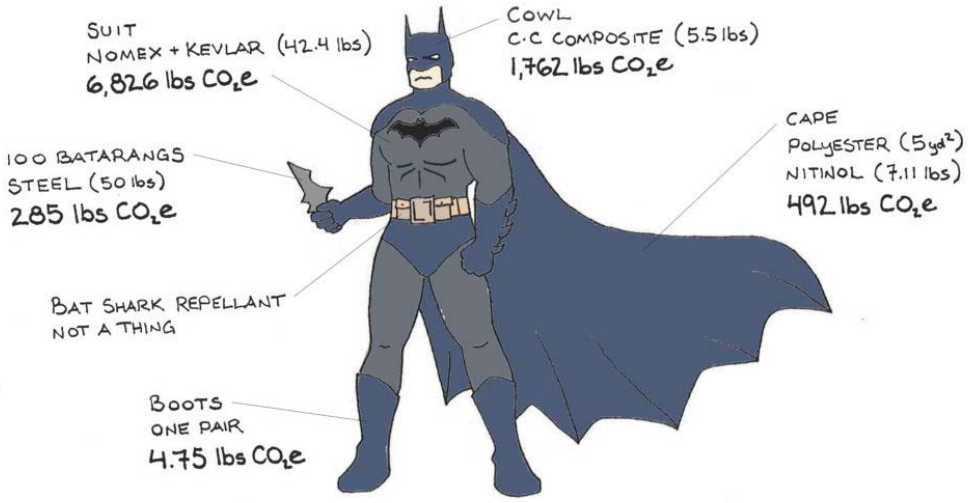
• Pseudoelasticity.

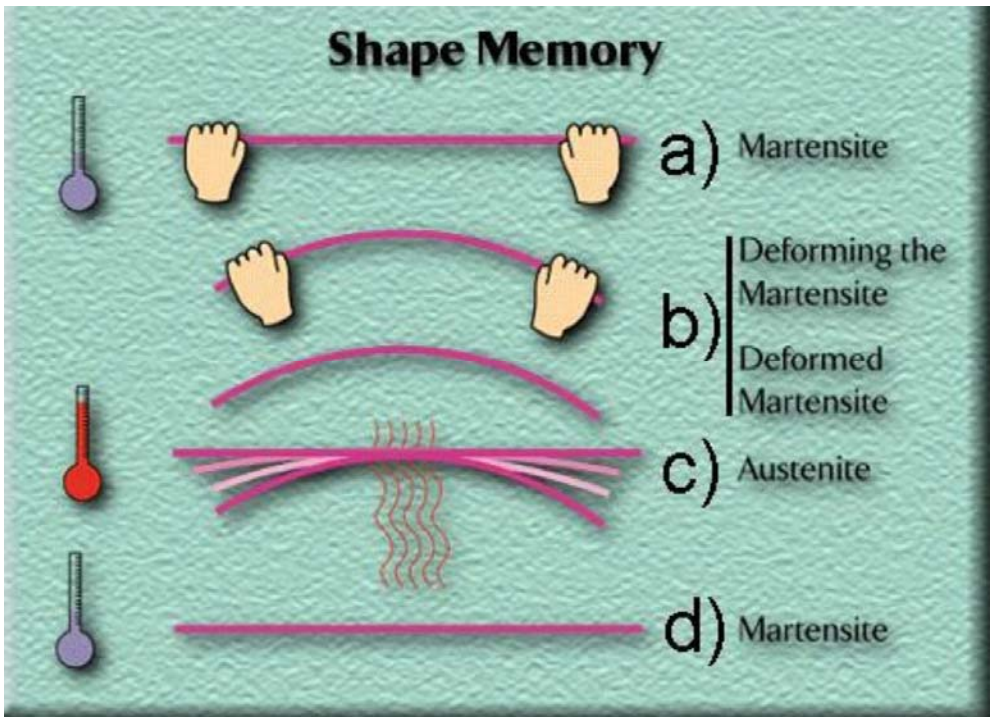
• Damping capacity.

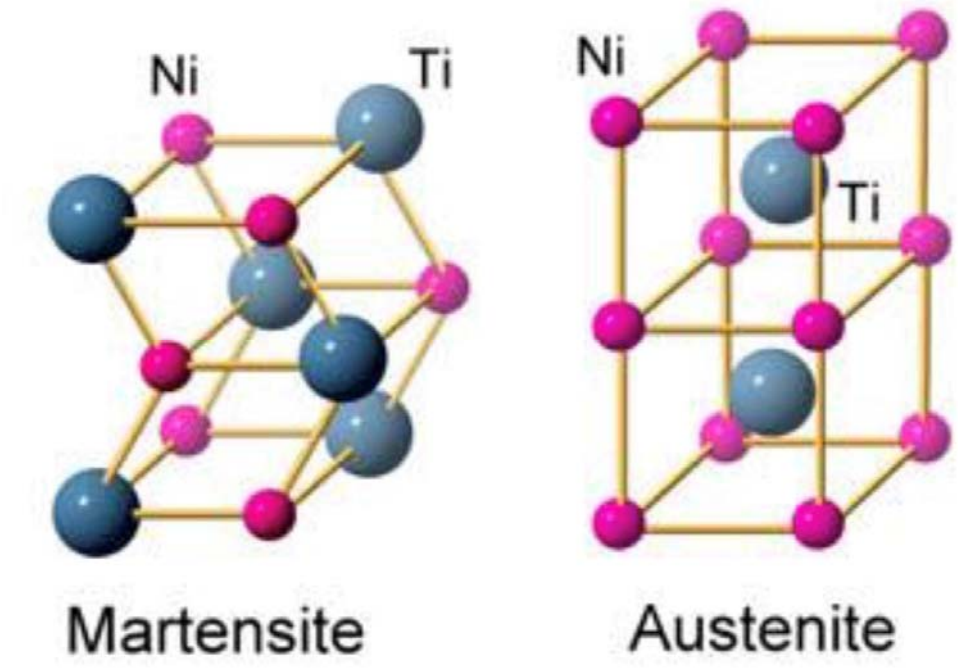
Process:

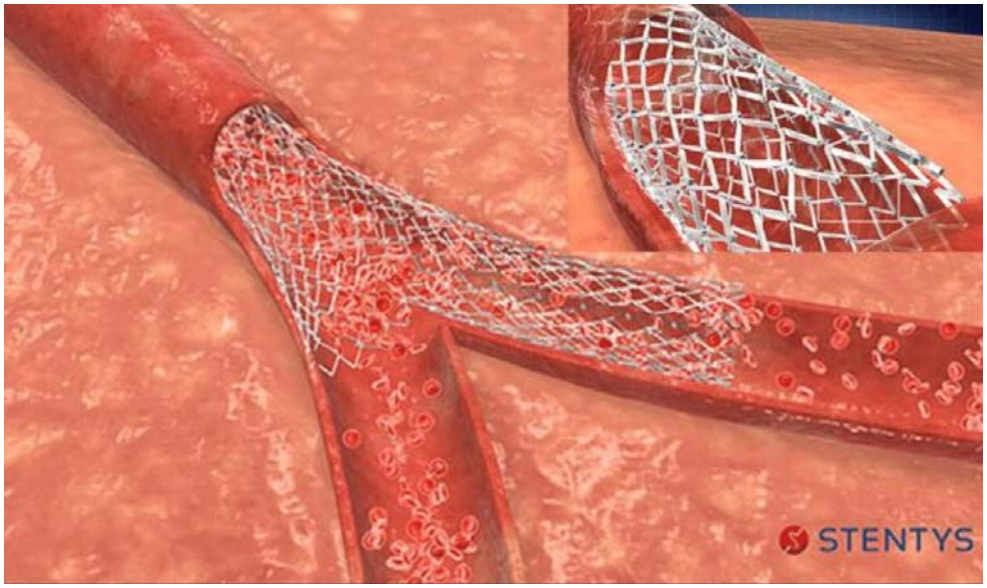
1. Take this metal and give it any forms of you want, like a heart or a circle for example.
2. Now put it in the hot water very slowly.
3. At this time you can see how it returns to it’s original form.

The superhero who has nitinol in his suit is batman. The properties that nitinol has give elasticity to the area of the layer and help it to protect itself in it’s combats.


SUIT
NOMEX + KEVLAR (42.4 lbs)
6,826 lbs CO_2e
COWL
C·C COMPOSITE (5.5 lbs)
1,762 lbs CO_2e
100 BATARANGS
STEEL (50 lbs)
285 lbs CO_2e
CAPE
POLYESTER (5 yd^2)
NITINOL (7.11 lbs)
492 lbs CO_2e
BAT SHARK REPELLANT
NOT A THING
BOOTS
ONE PAIR
4.75 lbs CO_2e


Shape Memory
a) Martensite
b) Deforming the Martensite
Deformed Martensite
c) Austenite
d) Martensite


Ni
Ti
Martensite
Ni
Ti
Austenite


STENTYS

2. Hydrogel:

A hydrogel crystal is a long chain of molecules bonded together to form a superabsorbent polymer that does not dissolve, but forms a gel when placed in water. Itis often used in gardening, landscaping, and farming as a way of retaining moisture. The crystal is made up almost entirely of water. As the crystals dry, water is slowly released to the soil. Some of these crystals can soak up as much as 500 times their weight in water. This superabsorbent characteristic makes hydrogel crystals useful in solving water conservation issues.

This science fair project focuses on a special kind of polymer called a hydrogel superabsorbent crystal which absorbs water, swelling to many times its original size. In addition to water these crystals will be tested to see if they will absorb a strong tea solution, if they are able to absorb the tea the crystals will be treated with both a salt and sugar solution to see which of the two will allow the crystals to retain the tea and which will cause the tea to be released.

These crystals act as a model of a drug delivery system. The drug is first loaded onto the carrier and then it is released at a specific time and location. The tea represents the drug and the hydrogel crystal is the carrier. The salt and sugar solutions represent possible releasing agents that will be investigated in this project. From the observations made a dataset will be produced.

Process:

1. Using a measuring cup pour 4 ounces of orange juice, vegetable oil, milk, rubbing alcohol, vinegar, club soda, and distilled water into clear plastic cups.
2. Place one or two crystals in each liquid. The crystals will begin to grow immediately.
3. Observe what happens to the crystals after 30 minutes, 1 hour, and 1 ½ hours. How has the crystals changed?
4. Allow the crystals to grow to a point where they cannot be seen clearly inside the cup.
5. Measure the liquid left in each cup by pouring the residue liquid into a measuring cup, using a stranger or paper filter to catch the crystals.
6. Determine how much liquid is left after crystal absorption by subtracting the amount of liquid poured in the measuring cup from 4 ounces.
7. For a more scientifically accurate investigation the entire processed should be repeated twice more. Record the results in a table similar to the one shown below.

Elements:

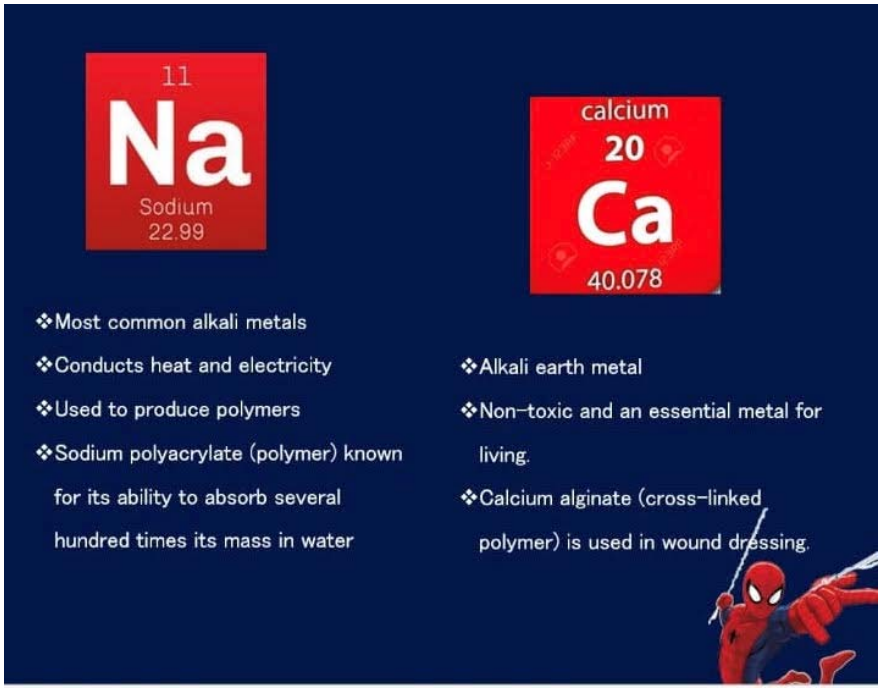
- ⇨ Na-Sodium polyacrylate (polymer) known for its ability to absorb several hundred times its mass in water.
- ⇨ Ca- Calcium alginate (cross-linked polymer) is used in wound dressing. Is highly absorbent, biodegradable.

Hydrogel applications:

- ⇨ Contact lenses
- ⇨ Tissue engineering
- ⇨ Drug delivery systems
- ⇨ Wound dressing

Superhero link:

- ⇨ Spiderman's super strong spider web.



3. Density:

The experiment name is "Trap the superhero". This experiment is based on the superhero named Magneto, who has the ability to generate and control magnetic fields. A magnetic field is an idea that we use as a tool to describe how a magnetic force is distributed in the space around and inside something magnetic. Trap the superhero consists of the density. Density is the relationship between the weight and volume of a body. When you put the superhero in the bottle he floats, but when you put pressure on the bottle go down to the bottom, this is because the compression of the bottle will increase the density of the superhero, increasing the density of the super hero will decrease, when you release pressure it will come back and go up. By adding the paperclips and putting pressure on the bottle the superhero will come down creating an attraction between the magnet and

the paperclips, when an attractive force is applied, the electron charges are agitated and begin to move in the direction of applied force.

Process:

1. Fill an empty bottle with water
2. Then you put the superheroes inside the bottle with water and you can see how the superhero goes up and down without staying at the bottom of the bottle.
3. So, we add some paperclips in the bottle and observe the superhero.
4. This time we can see how the superhero staying in the bottom of the battle water.
5. YOU TRAP THE SUPERHERO

Character:

The character is a powerful mutant, one of a fictional subspecies of humanity born with superhuman abilities, who has the ability to generate and control magnetic fields. Magneto regards mutants as evolutionarily superior to humans and rejects the possibility of peaceful human-mutant coexistence; he initially aimed to conquer the world to enable mutants, whom he refers to as homo superior, to replace humans as the dominant species.