

Key Stage 3 – Materials

Total Recall film

In this demonstration make silicon from sand with a mighty explosion!

Demonstration for year groups: 7-11 (ages 11-16)

Educational objective

To demonstrate the properties of shape-memory metals.

Key student learning

- Memory metals can be moulded ('trained') into a desired shape and will always return to ('remember') that shape with application of heat.
- This property makes them suitable for a range of useful applications.

Notes on using the films in the classroom:

When you are showing the films to the class, for example on an interactive whiteboard, consider pausing the film at various intervals to involve and extend your students, e.g.

- What do you think will happen next?
- Why has that happened?
- What chemical reaction has occurred? How would we write that?

You may want to consider relating the demonstration to examples of work you have done in the class. If you prepare the materials in advance you could even get your students to conduct the demonstration alongside the film (see Safety information).

Try this in the classroom

Materials list

- Piece of memory metal (available from educational suppliers including the Science Museum Store)
- Tweezers
- Match, Bunsen burner or beaker of boiling water

Method

- Bend the memory metal out of shape.
- Heat the metal with the flame or hot water.
- Cool and repeat.

Safety information

Make sure that you wear goggles and appropriate protective clothing while conducting this experiment. Be aware that the metal will be hot so use tongs and/or heat-proof gloves when handling it. For detailed safety information contact [CLEAPSS](#).

Discussion

- Think about the effect of temperature change on a variety of materials.
- What happens to particles in a solid when you give them energy (heat)?
- Shape-memory metal behaves as it does because the metal has in effect two solid states at different energy levels. When the atoms in the metal are given energy, they rearrange themselves, changing the overall structure.
- How does this compare with changes of state in other materials?
- How might this be useful?

Extensions

Is there any way you can get your memory metal to 'forget' the shape it has been trained to return to?

Links to everyday life

Pseudo-elastic glasses frames

Shape-memory metal is great for the frames of reading glasses, which are vulnerable to damage from being dropped, twisted or squashed. The frames instantly revert back to their original shape once the pressure is removed.



Flexon spectacles, c.1990s.



Silicon wafer

Medical applications

A stent can be placed in a blocked artery in its compact state and then in response to body temperature the shape-memory metal will expand to open up the artery.

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Curriculum links

Key Stage 3

This activity encourages practical enquiry skills in the area of 'Chemical and material behaviour', specifically:

- The particle model provides explanations for the different physical properties and behaviour of matter
- Changes of state - solid, liquid, gas
- Explanation of the different physical properties of each state
- Uses of metals based on properties