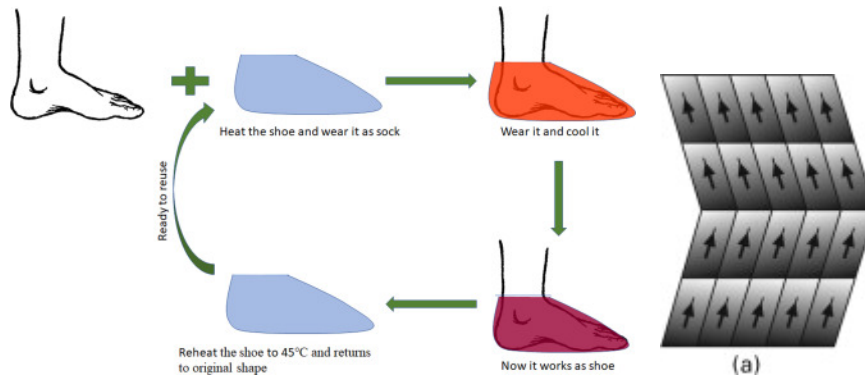


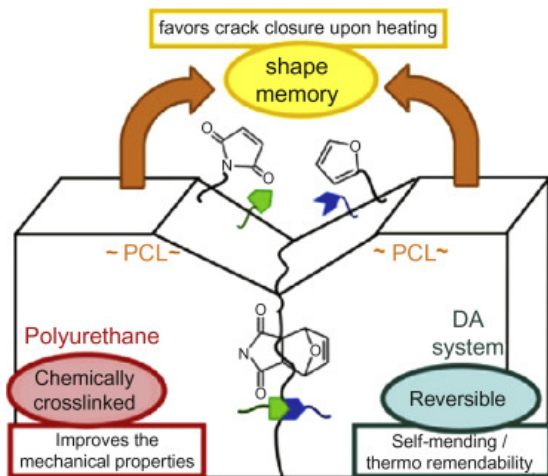
Shape memory materials- Properties and applications

Shape memory materials are a unique class of materials that can remember their original shape and return to it after deformation. It is due to reversible phase changes occur due to the changes in temperature or mechanical forces. Therefore the shape is changed in response to external stimuli.



Shape memory alloys (SMA): They are metallic alloys and can undergo reversible phase transformation between two crystal structures, austenite and martensite. The transformation is induced by change in temperatures. Ex. Ni-Ti, Cu-Ni-Al alloys.

Shape memory polymers (SMP): They change their shape with the changes in temperature, light, etc. They can be deformed temporarily and regain its shape when triggered. Ex. stents, sutures in biomedical applications, smart materials and textiles



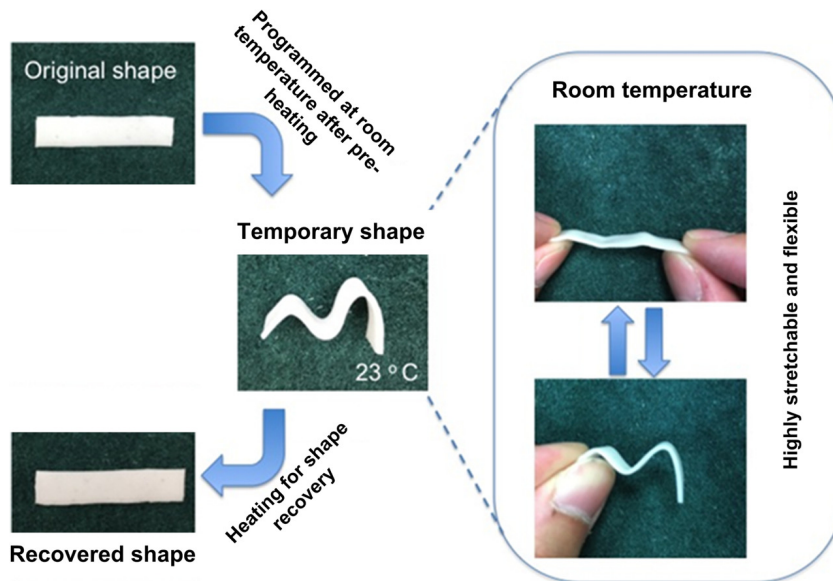
Shape memory Ceramics (SMC): The deformations can be occurred in SMC due to changes in stress, electric fields or magnetic fields.

Shape memory Hydrogels (SMG): These are hydrophilic polymers. They can change shape with the changes in temperature, pH or solvent composition. They are used in drug delivery, tissue engineering and bio-medical devices.

Shape memory Foams (SMF): These are porous materials, which changes shape temperature or pressure.

Applications:

1. Biomedical devices: stents, orthodontic wires and sutures. They change shape with body temperature.



2. Actuators: Robotics, Micro Electro Mechanical Systems (MEMS), aero space applications. They convert thermal or mechanical energy into motion
3. Adaptive structures: Structures that can adopt their shape to changing environmental conditions such as in self healing materials and morphing wings for aircraft
4. Sensors: Used as sensors that sense the change in temperature, pressure, etc.