

## Nitinol 'Memory' Metal

NiTi memory metal has two primary crystalline phase forms with a transition temperature around 70° C. At high temperature the NiTi alloy is in the Austenite phase while at low temperature, the alloy is in the Martensite phase. In the Martensite phase the nitinol may be easily deformed. When the alloy is heated to the Transition phase, the nitinol reverts to its original form. Thus, the metal appears to 'remember' its original shape.



### Demonstration #1

*Memory Metal Remembers its Annealed Shape*

1. Bend or coil the wire
2. Heat the wire with a hair dryer and watch it straighten out as it returns to the preferred higher temperature annealed phase.
3. Alternatively, the bent NiTi wire sample can be dropped into hot water.
4. Still another variation of this demonstration uses resistive heating to change the NiTi wire to its Austenite phase. Simply connect each end of a short sample wire to a 9 volt battery (2 D-Cell batteries in series may be substituted) for a few seconds. As the wire resistively heats, it returns to its Austenite phase.

NiTi 'memory' wire is available from Images company in a multitude of forms. Visit our Nitinol page to see the many products we offer.

<http://www.imagesco.com/nitinol/nitinol-index.html>

### Demonstration #2

*Setting NiTi Wire into a new shape*

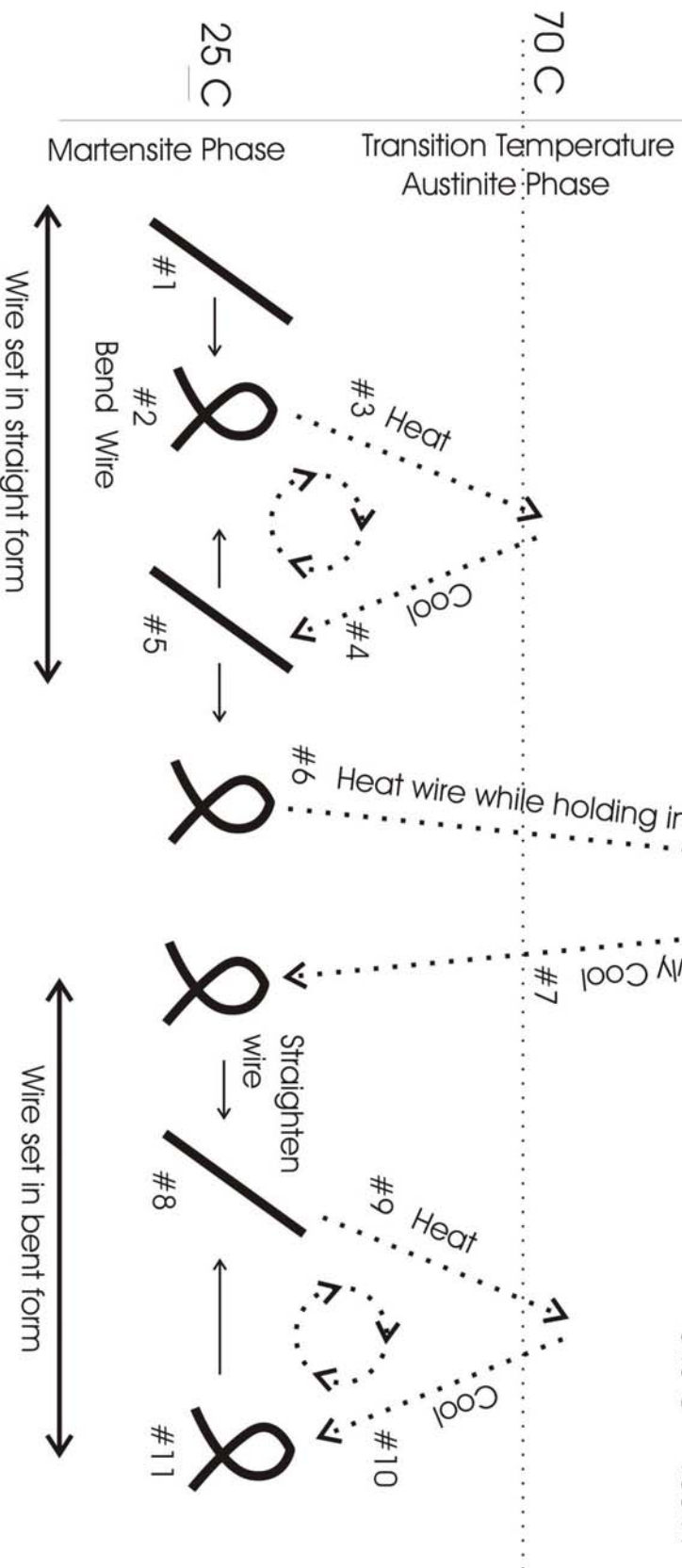
1. Place a sample of NiTi wire under tension by bending it and hold so that the wire maintains its bent shape.
2. Holding the wire carefully so as not to burn your fingers, bring the bent end of the NiTi Wire *close* to a candle or Bunsen burner flame. Heat it slowly until you feel a release of tension. At that point, remove the wire from the vicinity of the flame. Note do not heat the wire more than is necessary to release the tension.
3. Let cool. The NiTi wire has now been set into a new shape.
4. Repeat demonstration #1 to show that heating the wire will now cause it to return to its new bent shape.

# Mechanics of the Nitinol Shape Memory Effect

540 C Annealing Phase  
Temperature required to "train" nitinol



Notes:  
25 C = 77 F  
70 C = 158 F  
540 C = 1004 F



The wire is usually purchased "set" straight (step #1). Below the transition temperature, the Martensite form of the wire can be bent quite easily (step #2). When heated to the transition temperature (step #3), the unit cells change to the Austenite form and its originally "set" shape. The cycle (steps #4, #5a and #3) can be repeated many times. To "set" the wire into a new shape, heat it to 500° C while restricting its movement (steps #5b, #6, and #7). The new cycle (steps #8, #9, #10, and #11) can be repeated many times.