

# Making Shape Memory Rubber Bands

**Purpose** – Our purpose will be to produce a SMR and study its properties.

**Materials** - Hot Plate            2 Beaker (s)            Rubber band (any size)  
Stearic Acid            Thermometer            Tweezers (2)  
Isopropanol            Heat gun or hair dryer

**Safety** - Stearic Acid is a skin and eye irritant and should be melted in a hood.  
Hot Plates can cause burns.

**Procedure** -

1. Fill a beaker half full of stearic acid.
2. Place the beaker on the hot plate within the hood.
3. Put a thermometer in the beaker.
4. When the stearic acid has melted and has reached 65<sup>0</sup> C, add the rubber band(s).
5. Keep the rubber bands in the stearic acid for 20 minutes.
6. Remove the rubber band and use the tweezers to stretch it.
7. While it is stretched, place it in isopropanol for 1 minute.
8. Remove from the isopropanol and allow to dry.
9. When you want it to return to its original shape, place in hot water or heat with a hair dryer or heat gun.

Once the rubber band becomes a SMR, experiment with it...change the shapes !  
Be sure to take notes on your observations.

**Teacher notes**

## Production of a Shape Memory Polymer

A simple Shape Memory Polymer (SMP) can be produced in the high school lab using rubber bands of any size and stearic acid. The stearic acid can be purchased for a nominal fee. [For example, at Flinn Scientific it is only \$15.35 for 500 grams.]

- Procedure:
1. Using a hot plate, Melt the stearic acid in a beaker. (melting point: 70°C)
  2. Maintain the heat of the stearic acid at 75°C
  3. Place rubber bands in the beaker of stearic acid at 75°C and allow to swell for 20 minutes
  4. Remove rubber bands from the stearic acid using tongs/tweezers and change its shape by stretching or twisting the rubber band
  5. After stretching, twisting or curling, hold it in the new shape as you submerge the rubber band in cold water for ten seconds.
  6. The rubber band will maintain its new shape until you heat it again.
  7. The rubber band may be reused in this manner several times.

Notes: Lauric acid may be substituted for the stearic acid. It has a lower melting point, so a hair dryer or 50 - 60 °C can be used to trigger the shape recovery. However, longer swelling may be needed to obtain good shape memory properties depending on the rubber band used.