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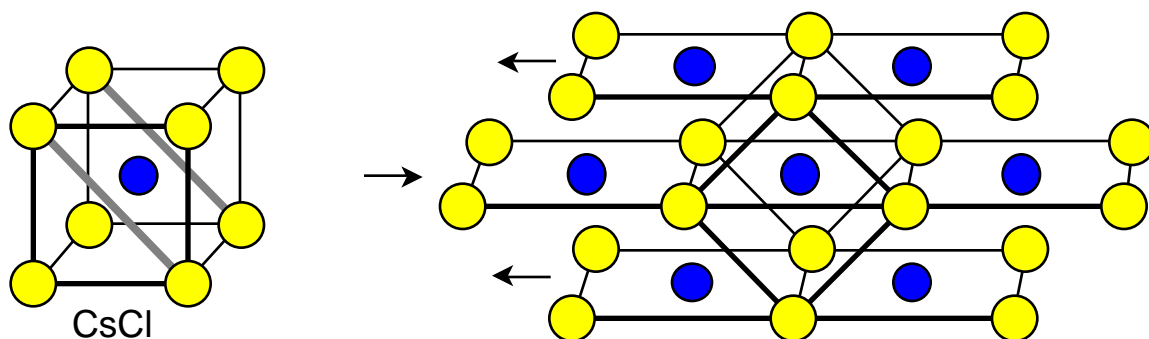
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## Laboratory Safety

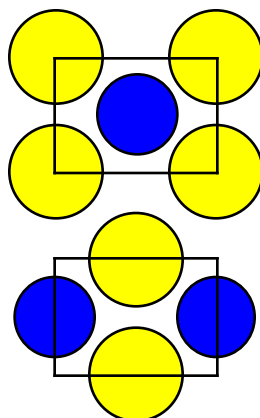
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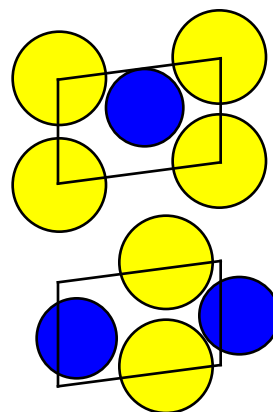
# NiTi Solid-State Phase Transition



Representation by  
layer sequence in  
the unit cell:

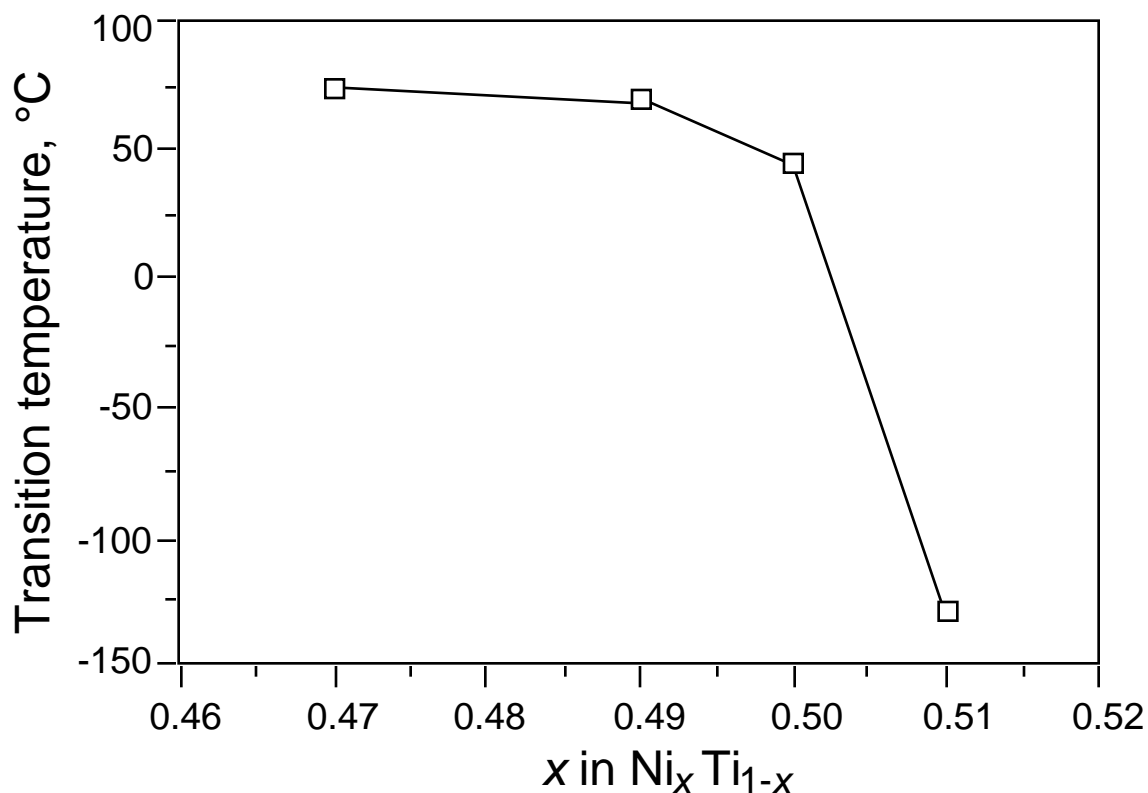


Austenite



Martensite

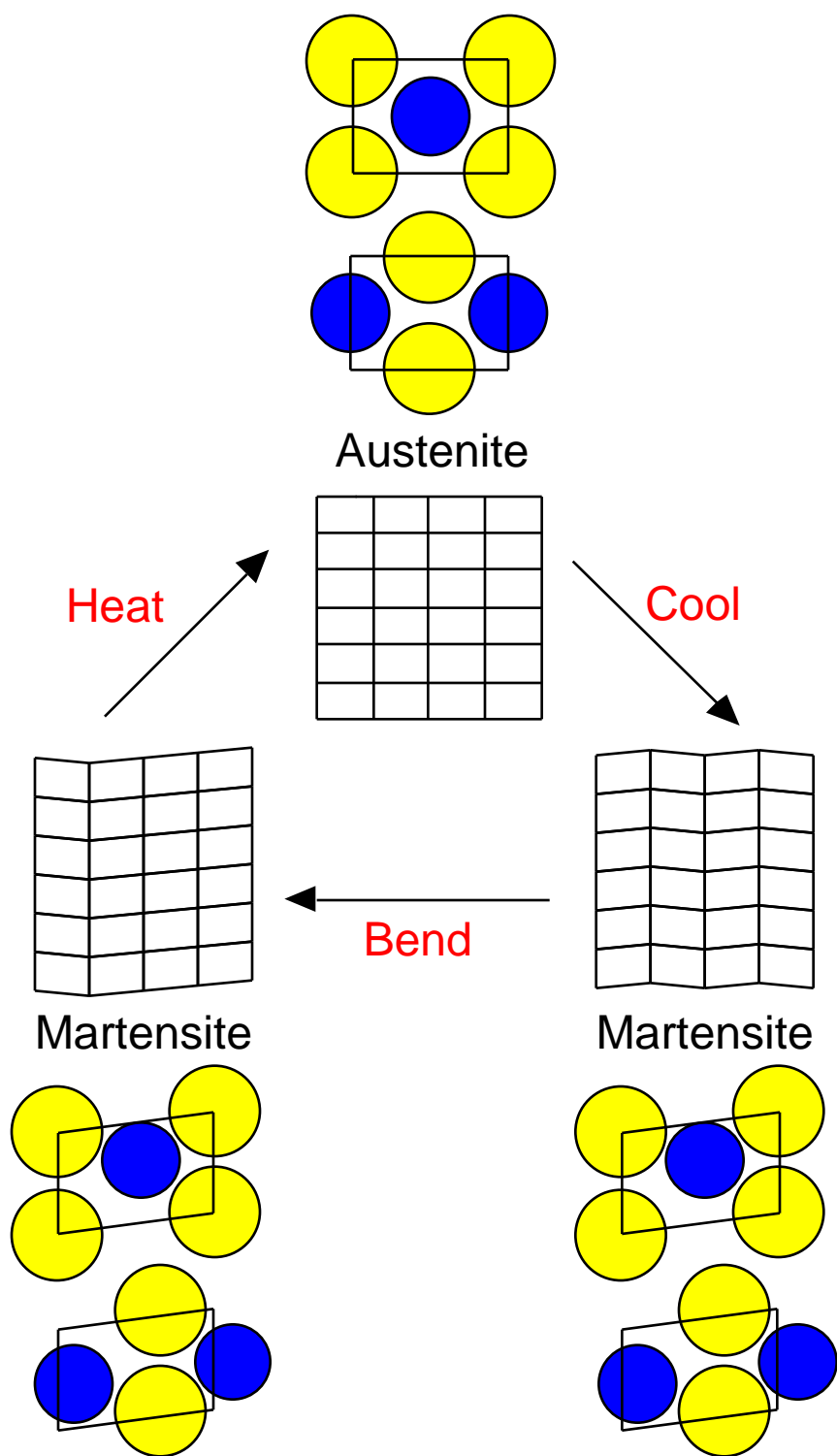
# Phase Transition Temperature and Composition



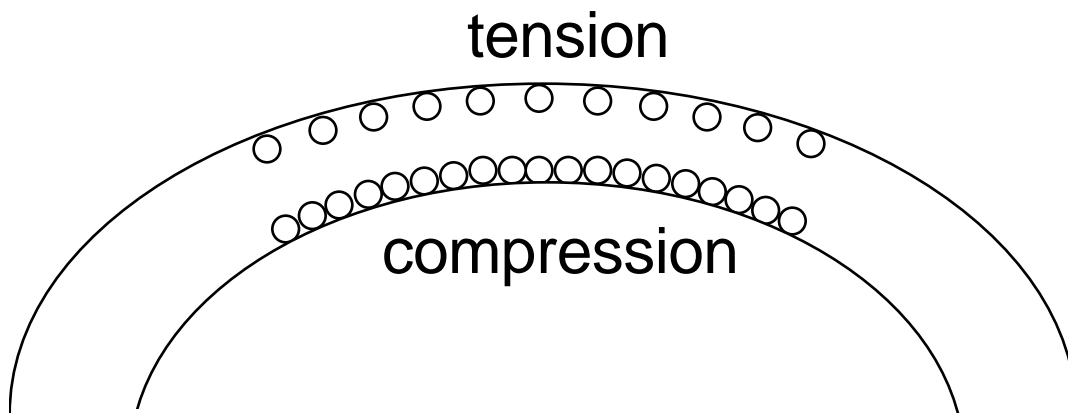
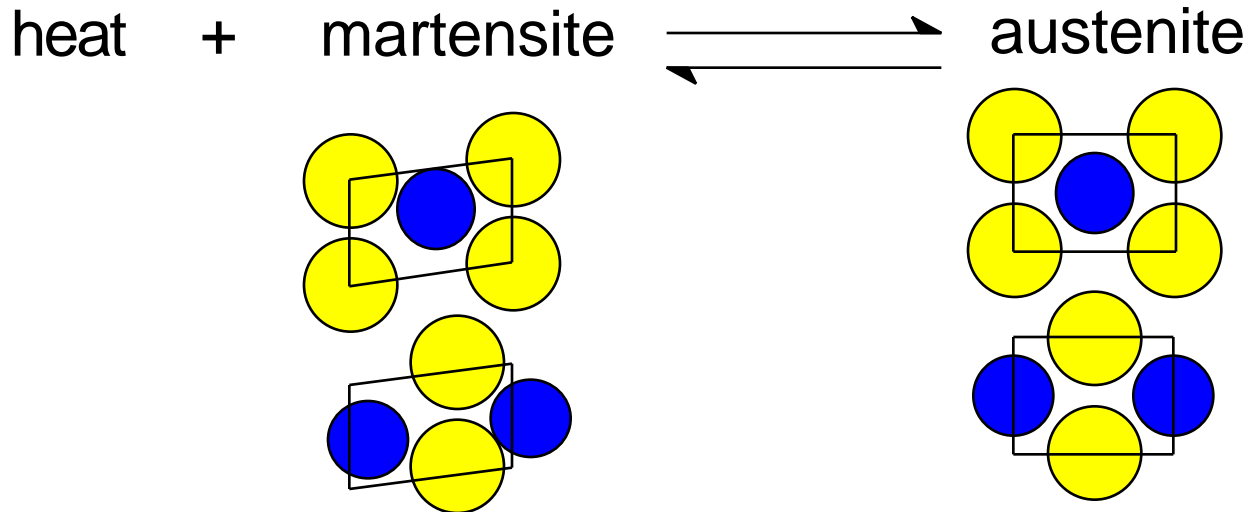
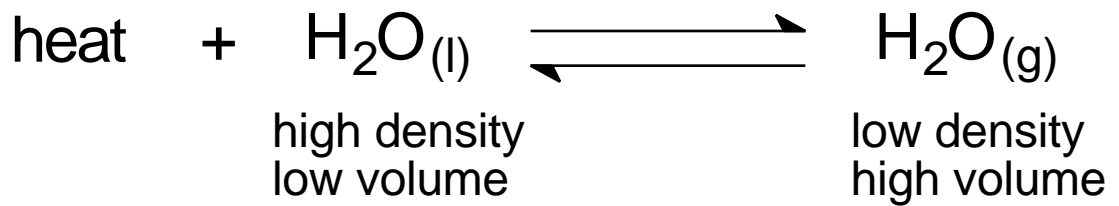
A 2% change in composition varies the transition temperature by  $150^\circ$ .

By varying the composition, either phase can be present at room temperature.

# Shape Memory Cycle

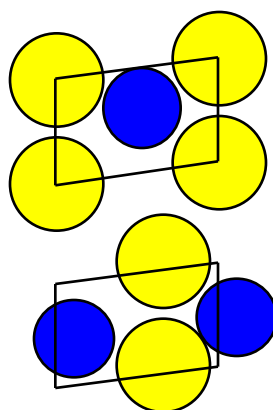


# Le Chatelier's Principle



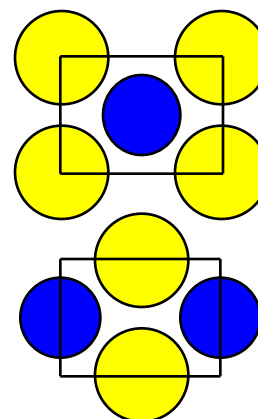
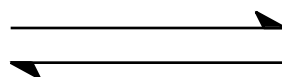
as  $P \uparrow$ , equilibrium shifts  $\leftarrow$

# NiTi Properties



energy + martensite

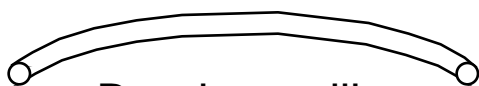
higher density  
lower volume



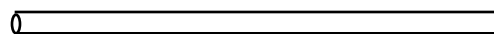
austenite

lower density  
higher volume

Superelasticity: stress or pressure, shifts the equilibrium to the left; it shifts back when pressure released

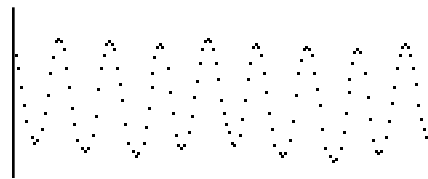
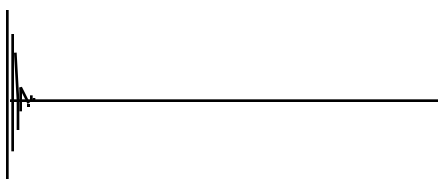


Bends readily



Very rigid

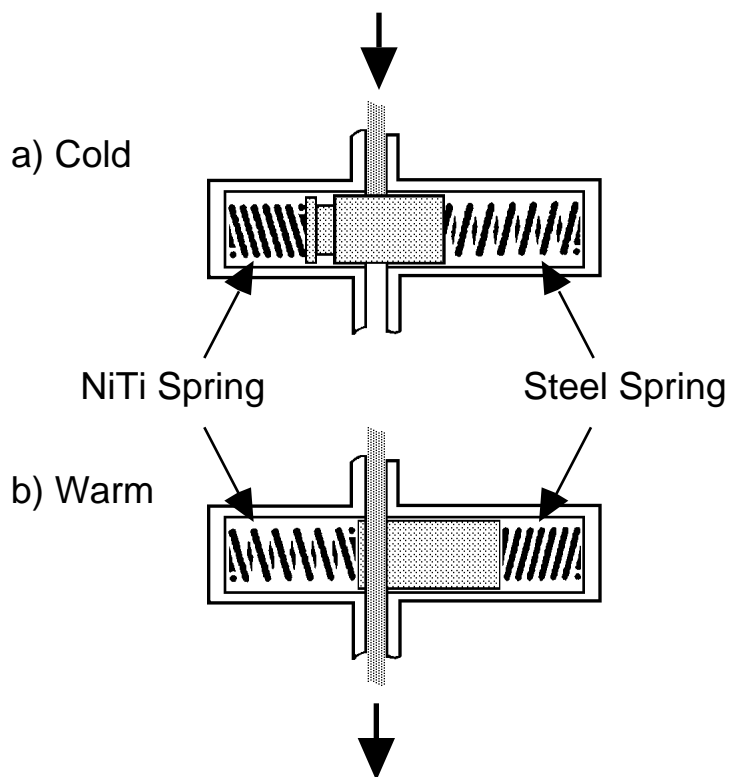
Ease of deformation arises from ability to realign different variants of the martensite structure.



Sound propagates more readily through the more symmetric austenite structure.

# NiTi Commercial Applications

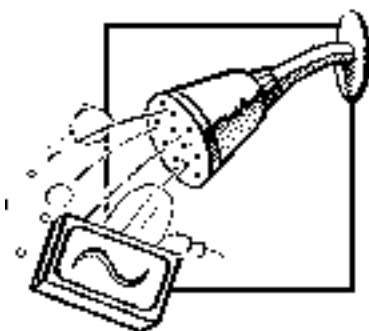
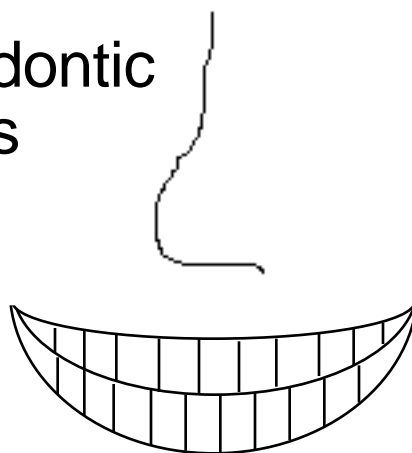
## Diesel Mercedes transmission fluid valve



Eyeglass  
frames



Orthodontic  
braces



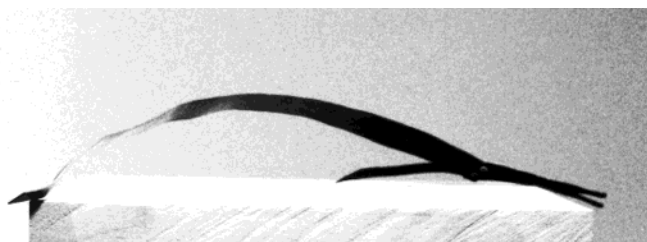
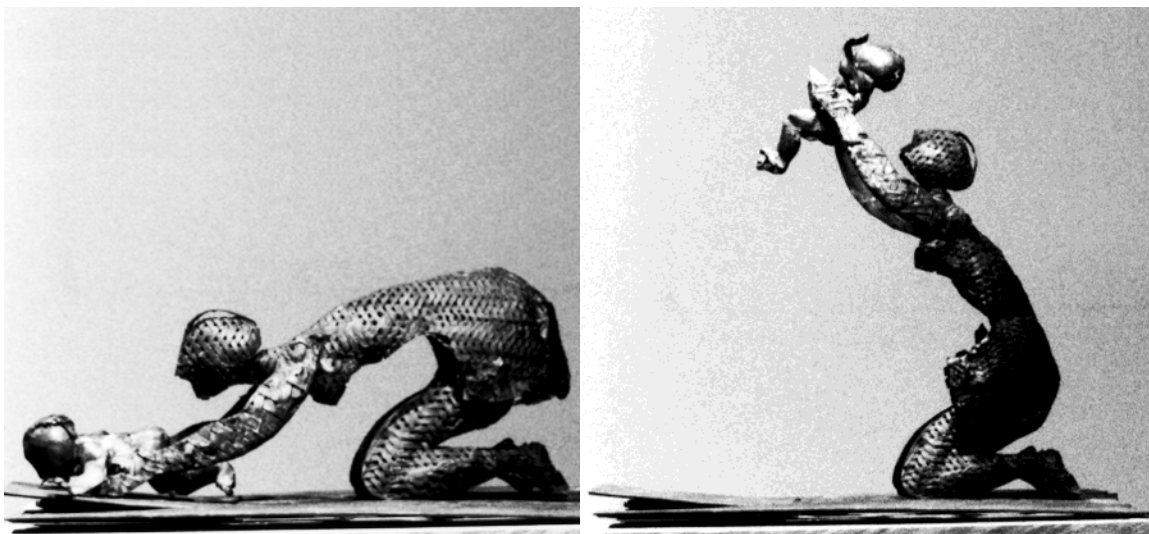
Anti-scald  
faucets



Surgical  
staples

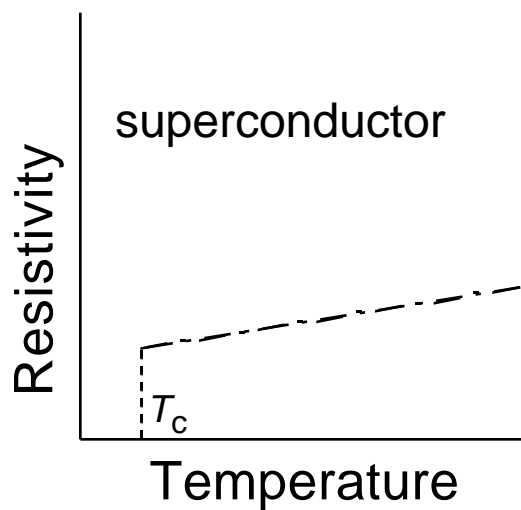
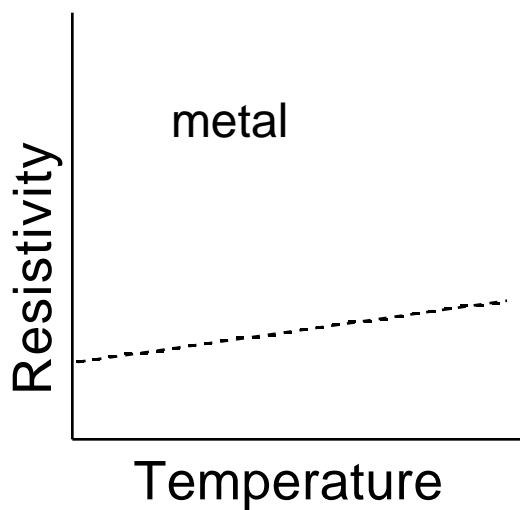
# NiTi Sculptures

by Olivier Deschamps

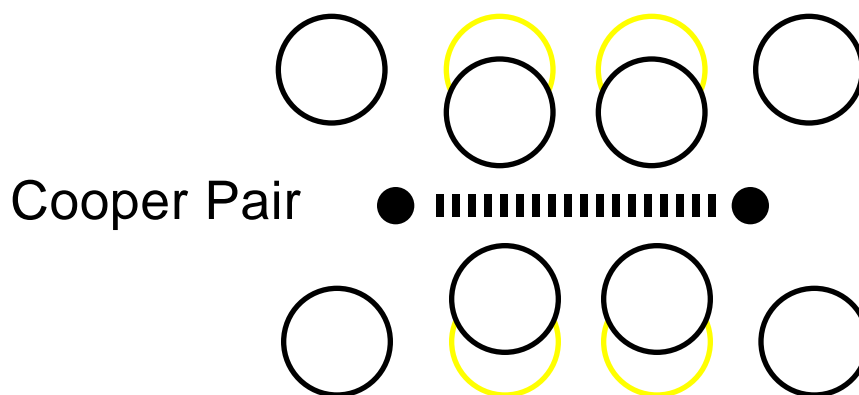
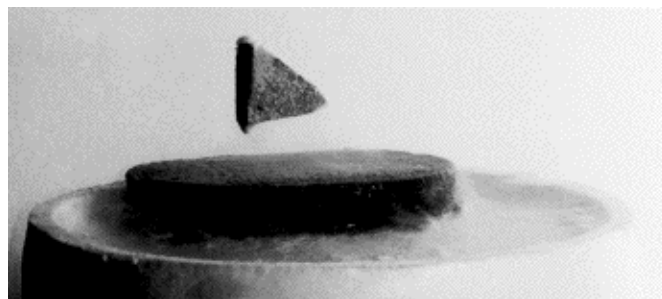
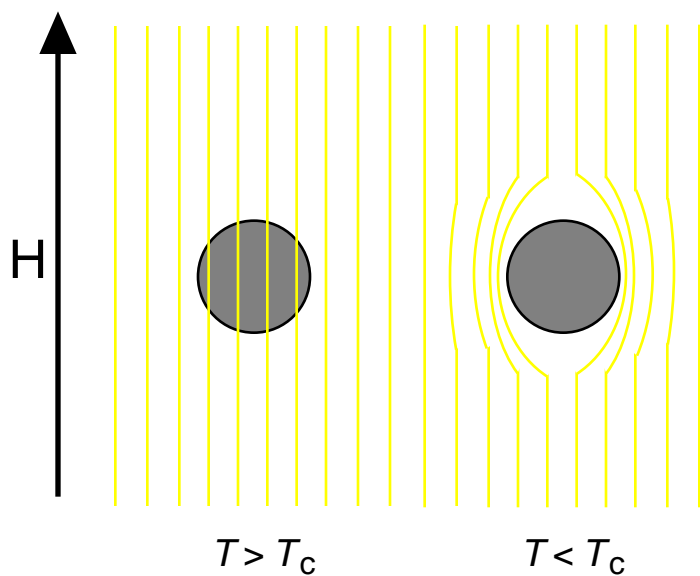




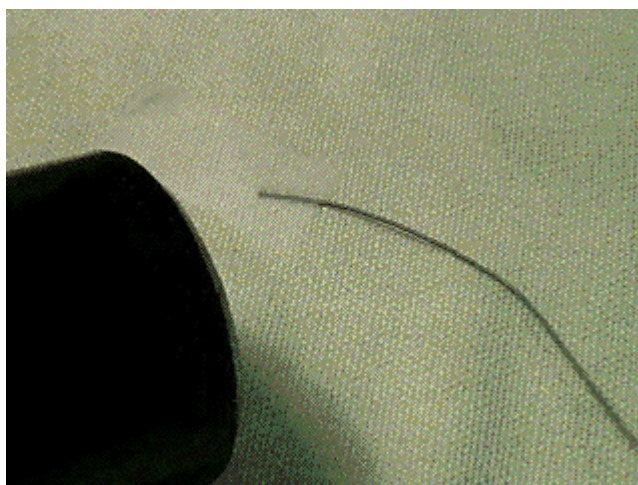
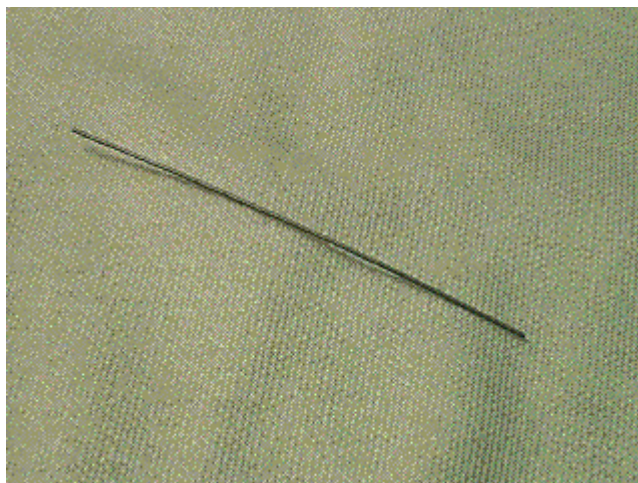
# Superconductors



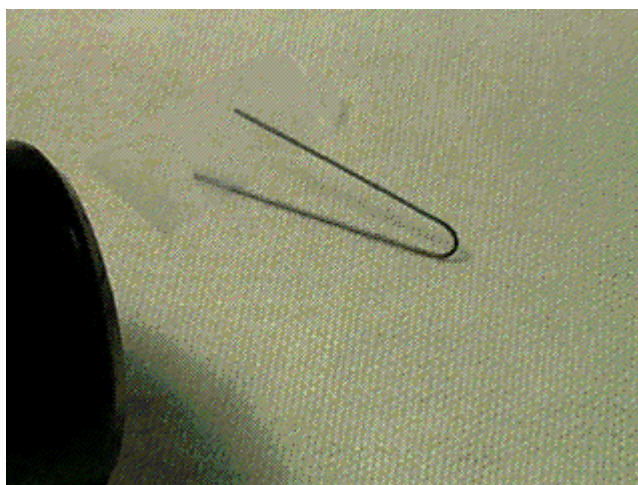
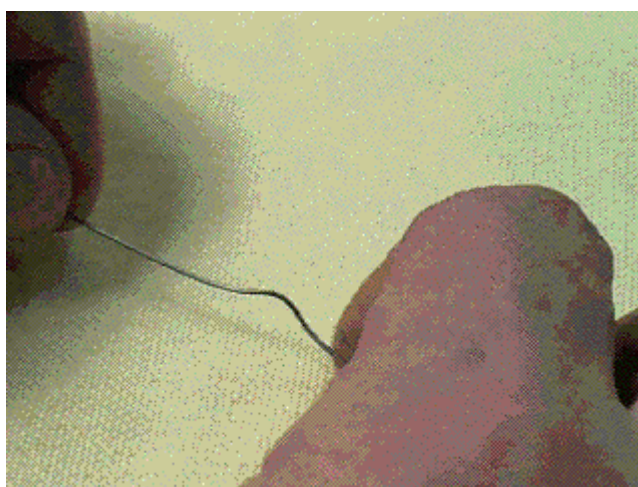
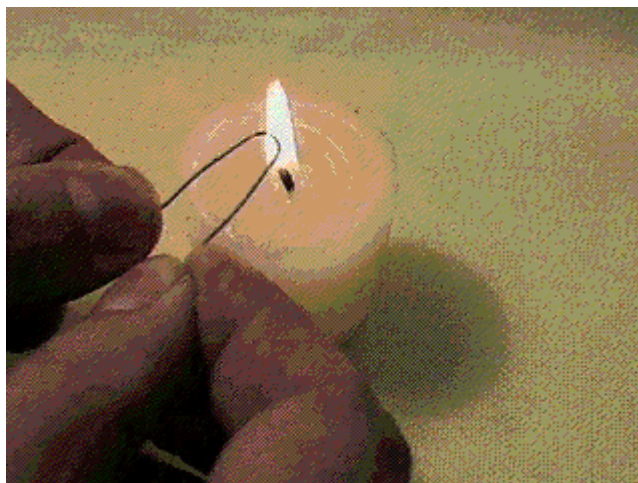
## Meissner Effect



# NiTi Solid State Phase Transition

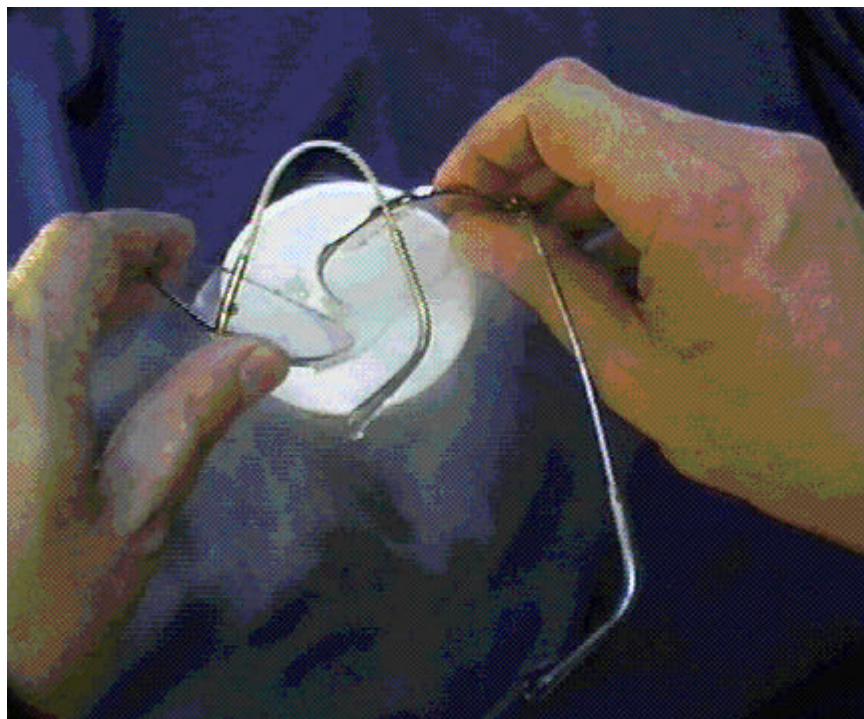


# Retraining NiTi Wire

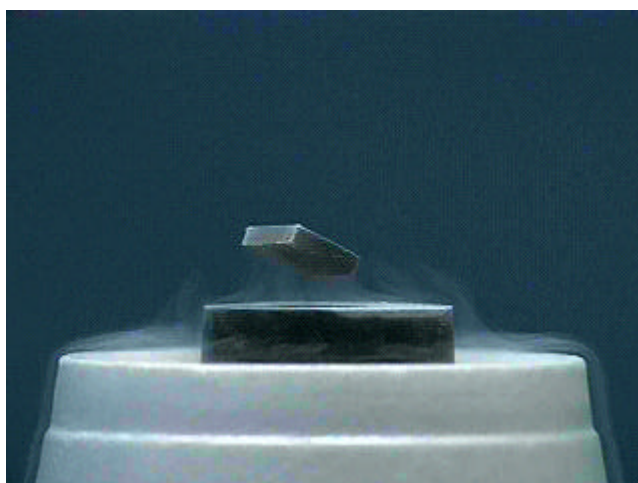
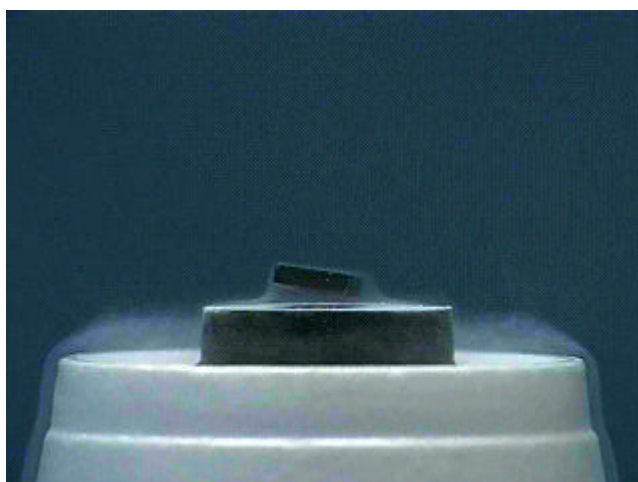
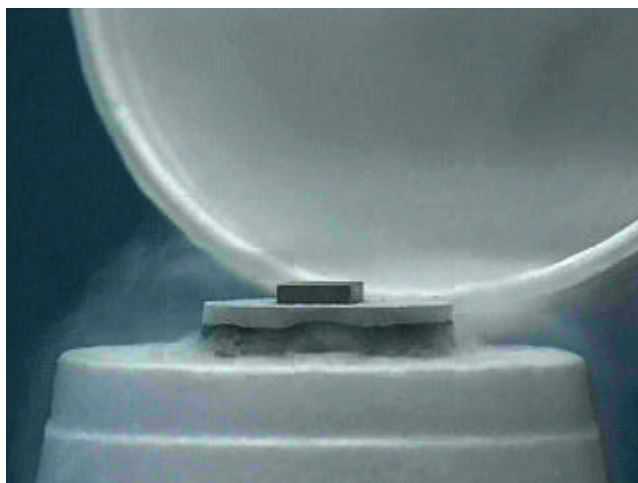




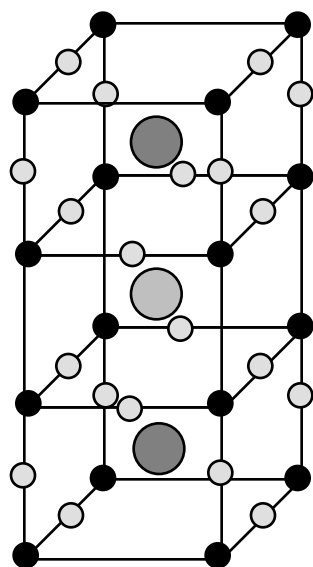
# NiTi Eyeglass Frames



# Superconductivity



# 1-2-3 Superconductor



- Barium
- Yttrium
- Copper
- Oxygen

## “Shake-And-Bake” Synthesis

Grind  $\text{Y}_2\text{O}_3$ ,  $\text{BaCO}_3$ , and  $\text{CuO}$  powders together, until they form a homogeneous mixture.

Heat for 18 hrs. at 910 °C.

Press pellets at 20,000 psi.

Heat pellets at 910 °C under nitrogen for 4 hrs.

Lower temperature to 520 °C and place under a flow of oxygen gas for a day.

Shut off furnace and allow samples to cool to room temperature while maintaining the oxygen flow.