

# Smart materials

Fiber Optics

Liquid Crystals

Shape memory alloys

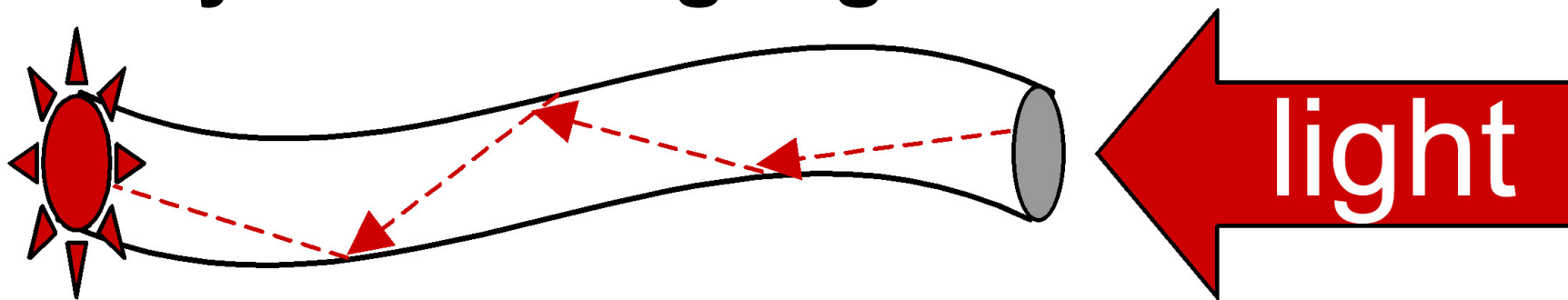
Ferrofluid

Amorphous Metal

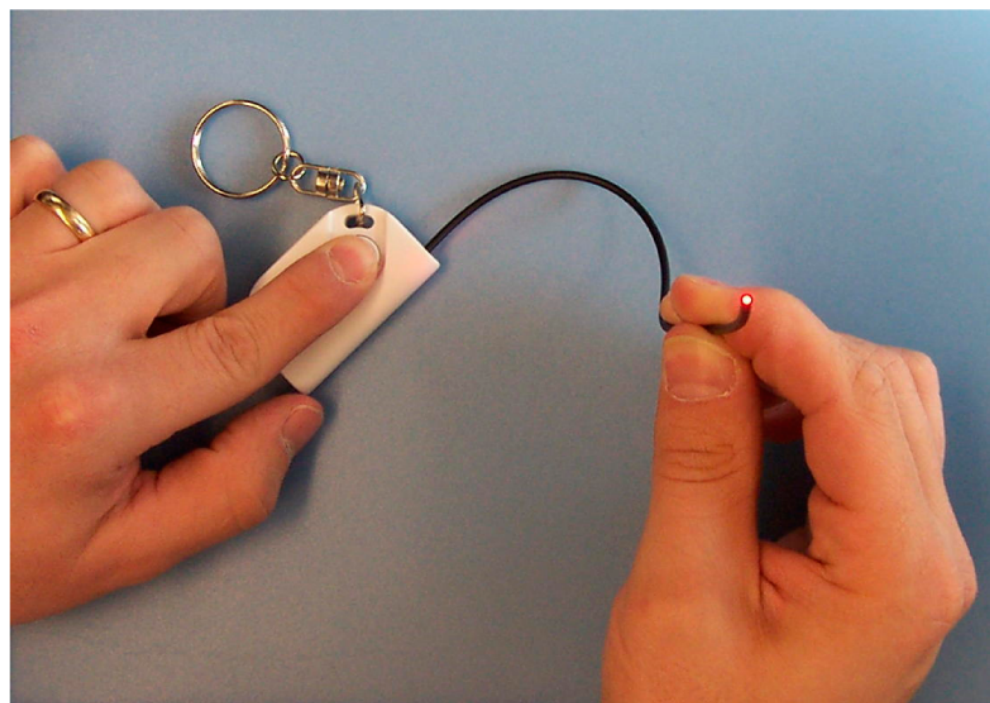
Thermoelectric

Piezoelectric

Light travels in a straight line.  
**Can you make light go around a corner?**



Try holding the LED flashlight at one end of a **fiber optic**, then gently **bend** the fiber and watch the light glow at the other end.





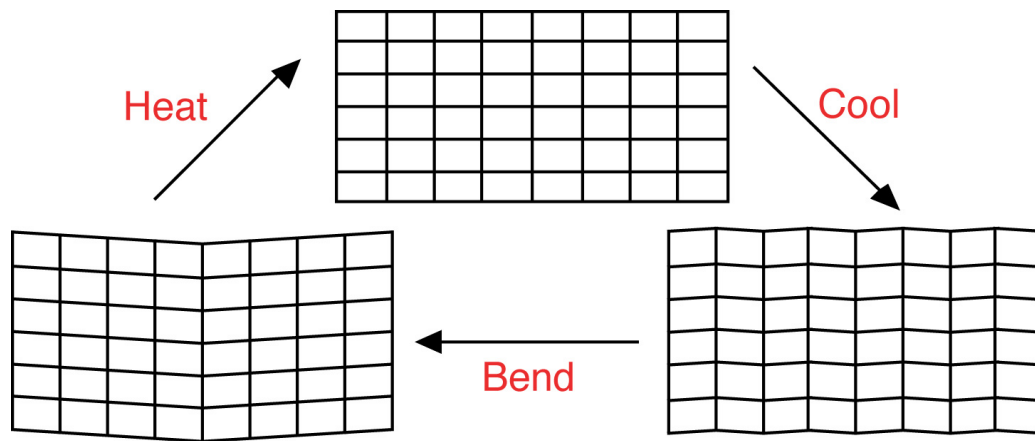
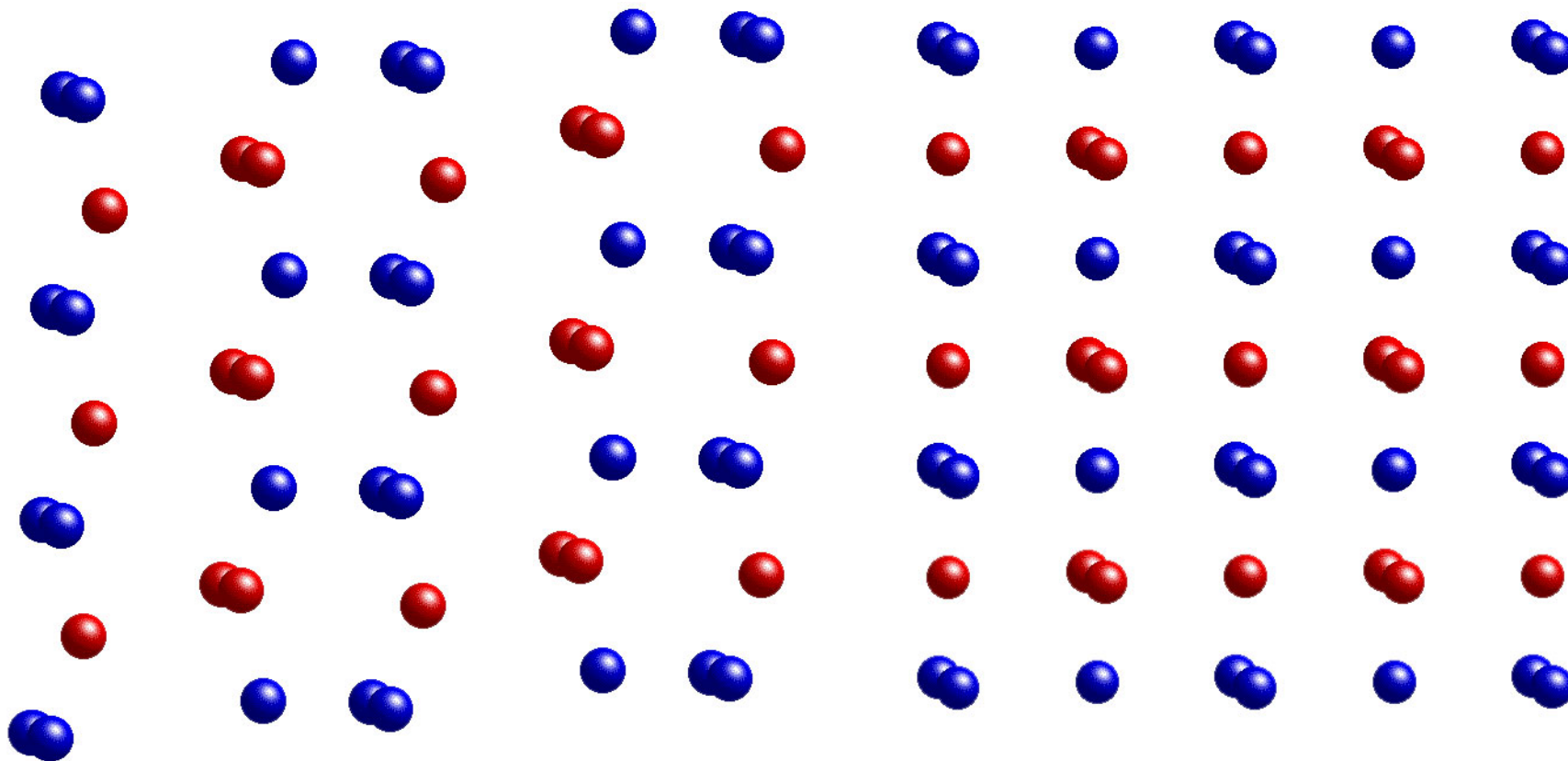
Take a piece of **memory metal wire** and bend it.

**Drop** the wire into very hot water.

What happens?  
Can you do it twice?

cold

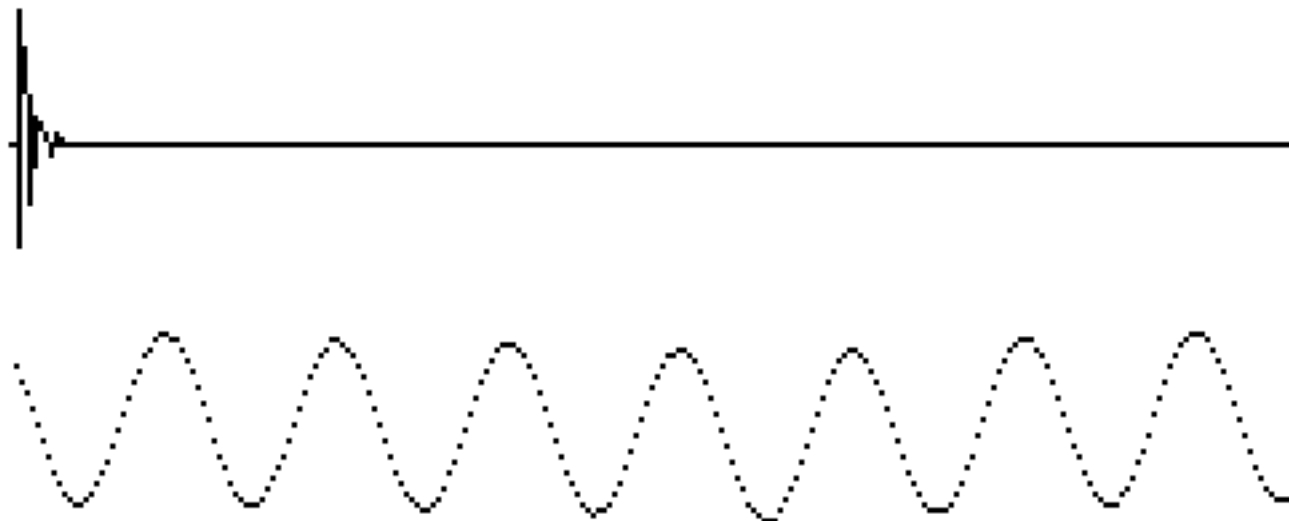
hot



**Listen** when you drop  
each **memory metal rod**.

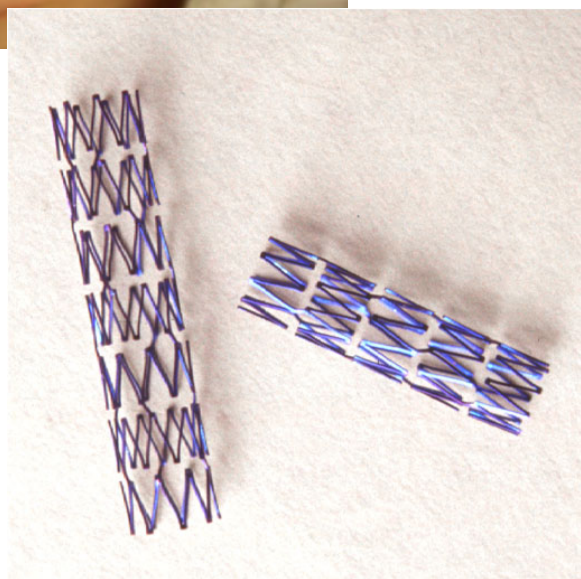


The more symmetric structure will ring.

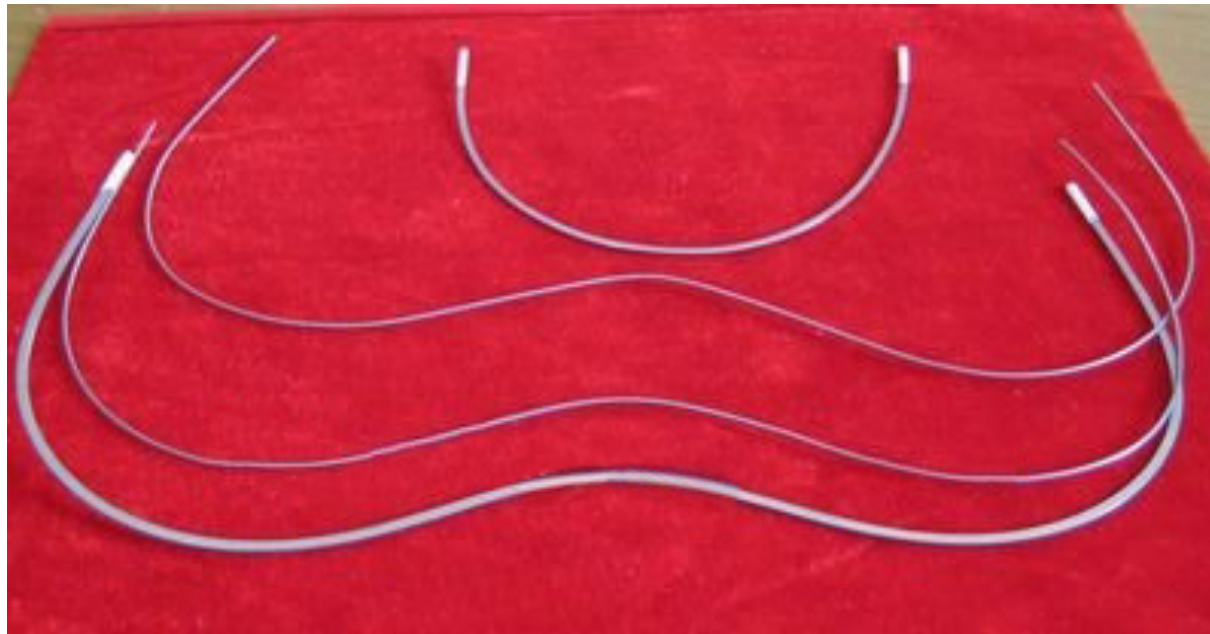
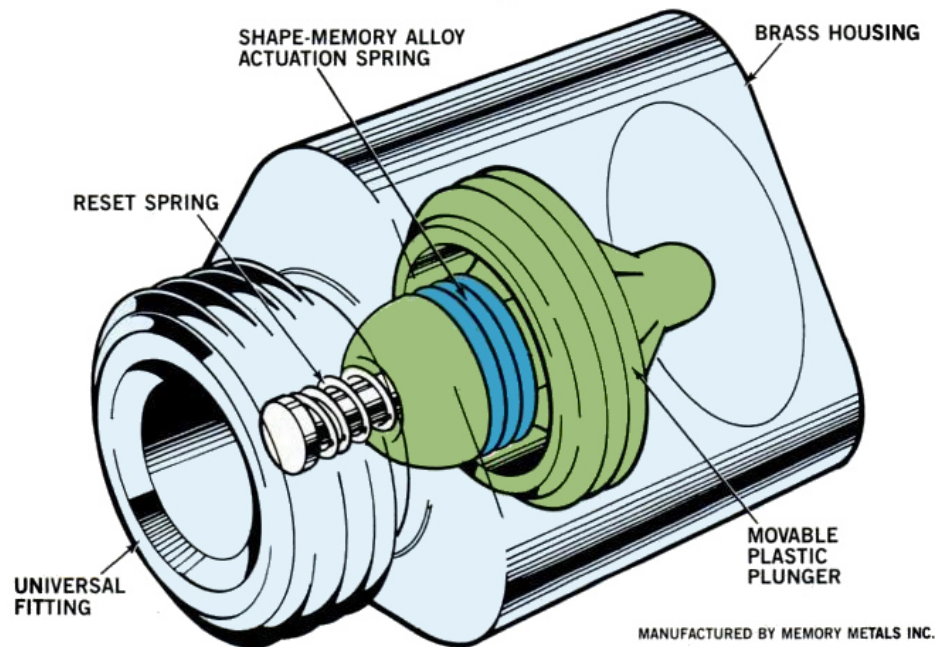


Which rod is the high temperature form?  
Which rod is the low temperature form?  
Can you **change** the ringing property?

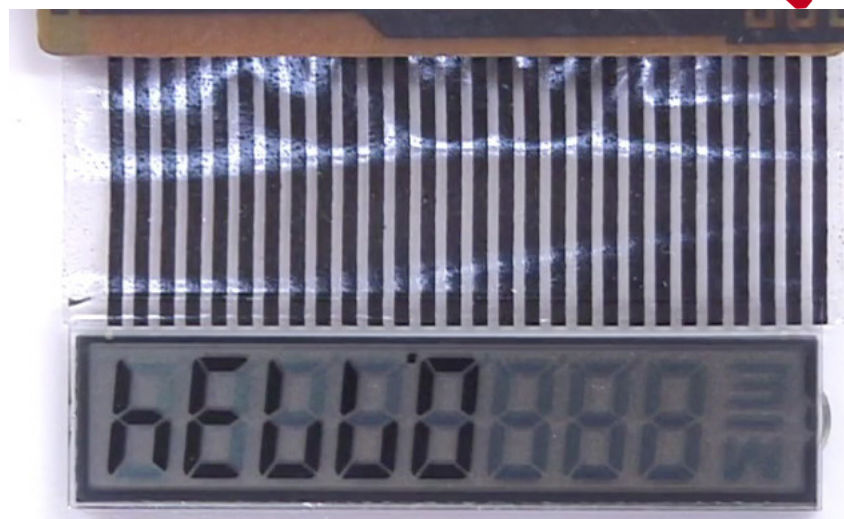
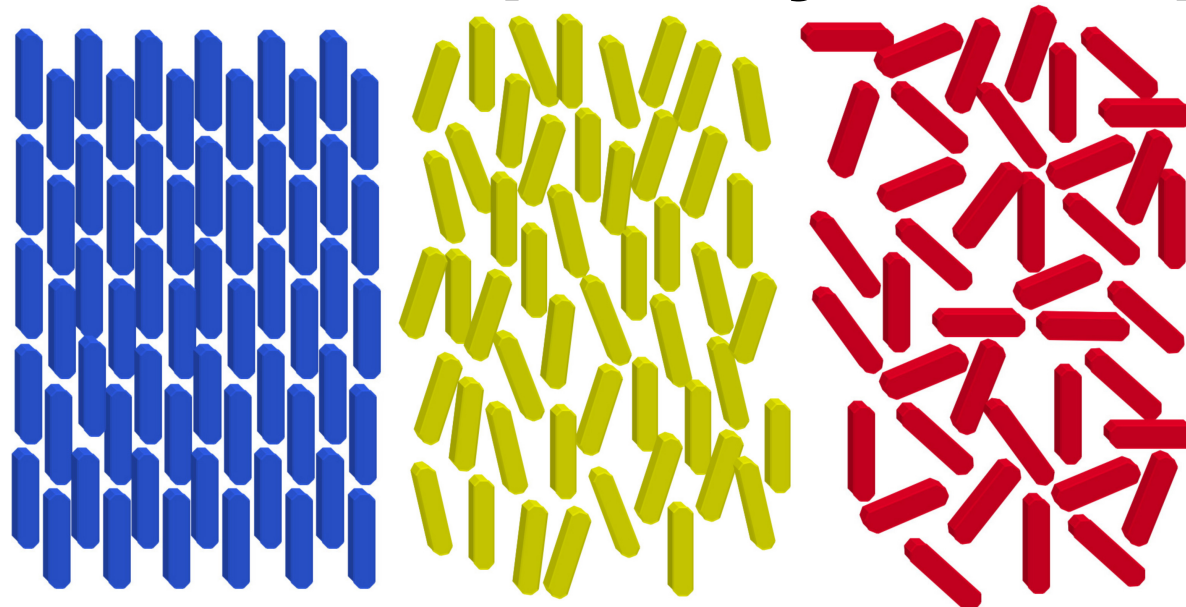
# What can you make with memory metal?



# Shower Gard anti-scald safety device



If you melt a liquid crystal display

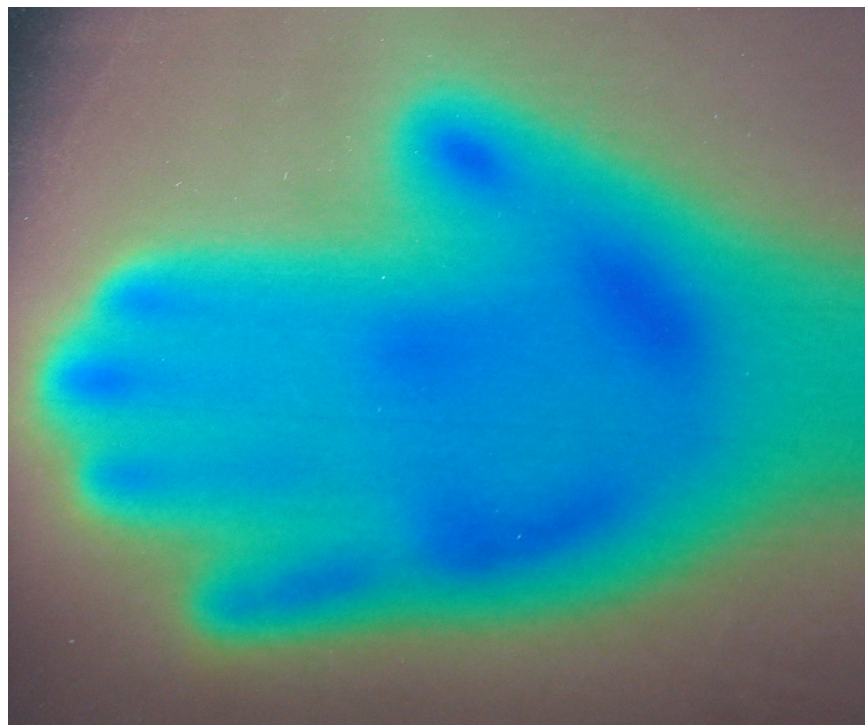


does it work again when it cools off?



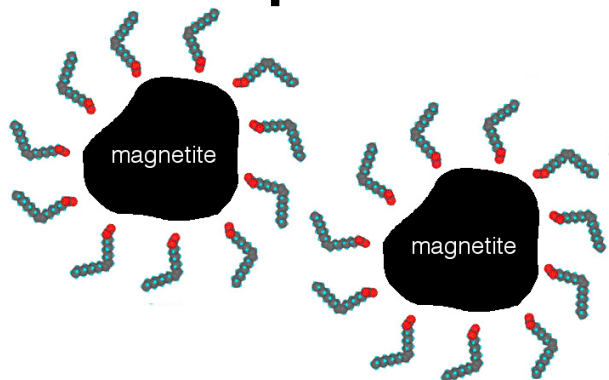
1. **Hold** your hand somewhere on the tabletop.

Use a **liquid crystal sheet** to see where your hand was.



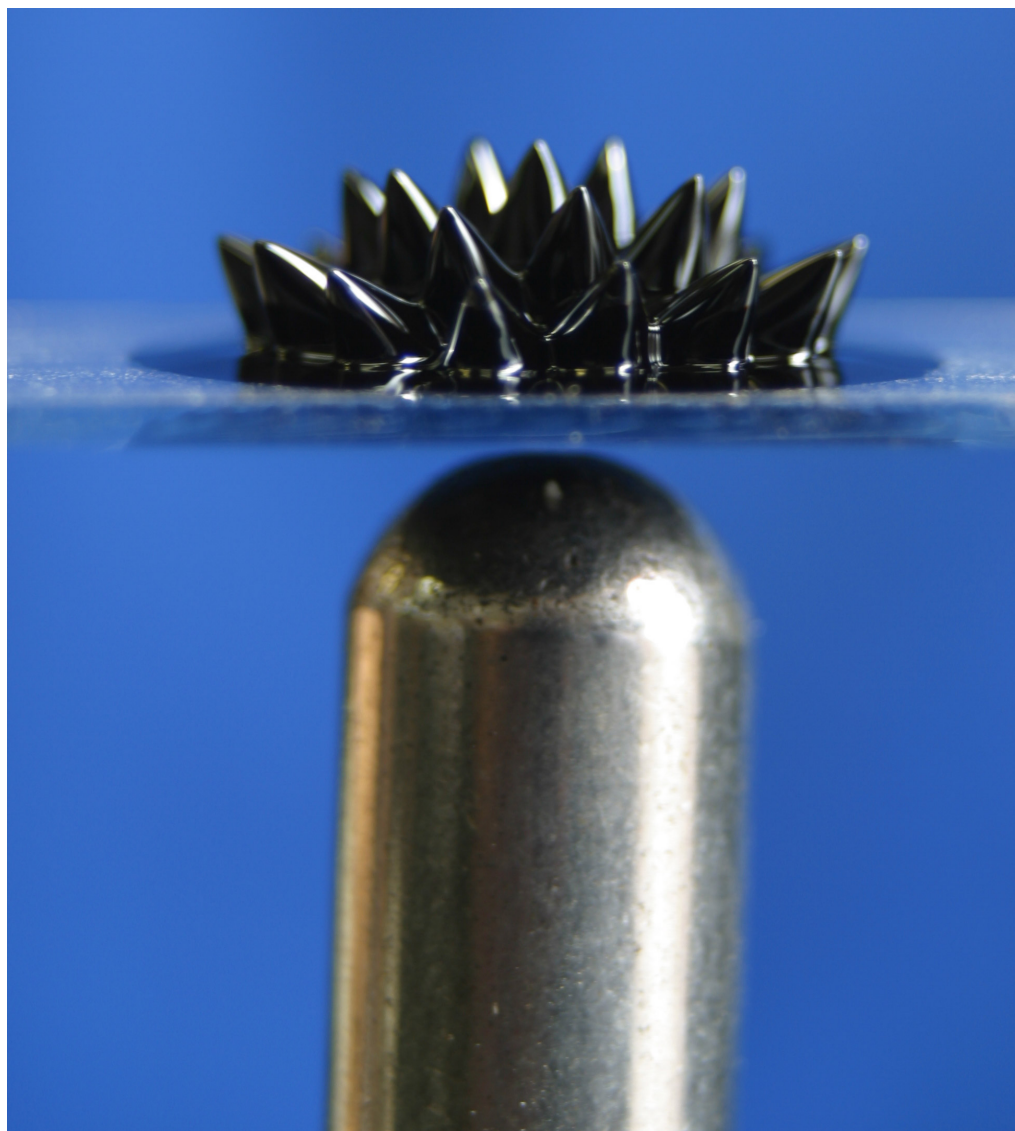
2. What objects have we hidden in the envelopes? (How can you tell without opening the envelope?)

Magnetite particles are solid but if you make them small you can suspend them in a liquid.



Do they still respond to a magnet?

**Can you attract a liquid to a magnet?**



Adjust the power to the electromagnet to make the ferrofluid go up and down.

Where is the magnetic field strongest?



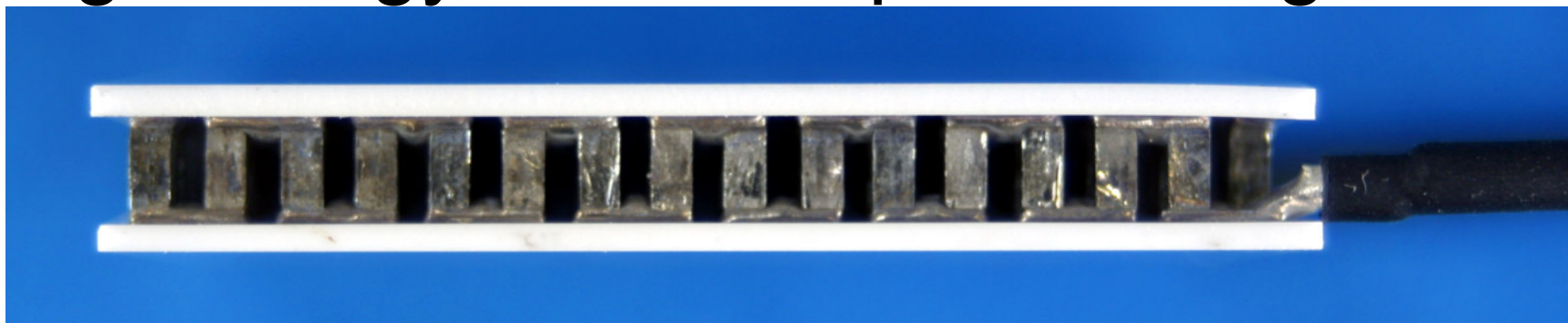
What do you see  
in the container of  
**baby oil?**

**Lift** the stick.  
Do you see the  
same thing?



What would you do with an invisibility  
cloak?

This material has a barrier that only lets high energy electrons pass through.

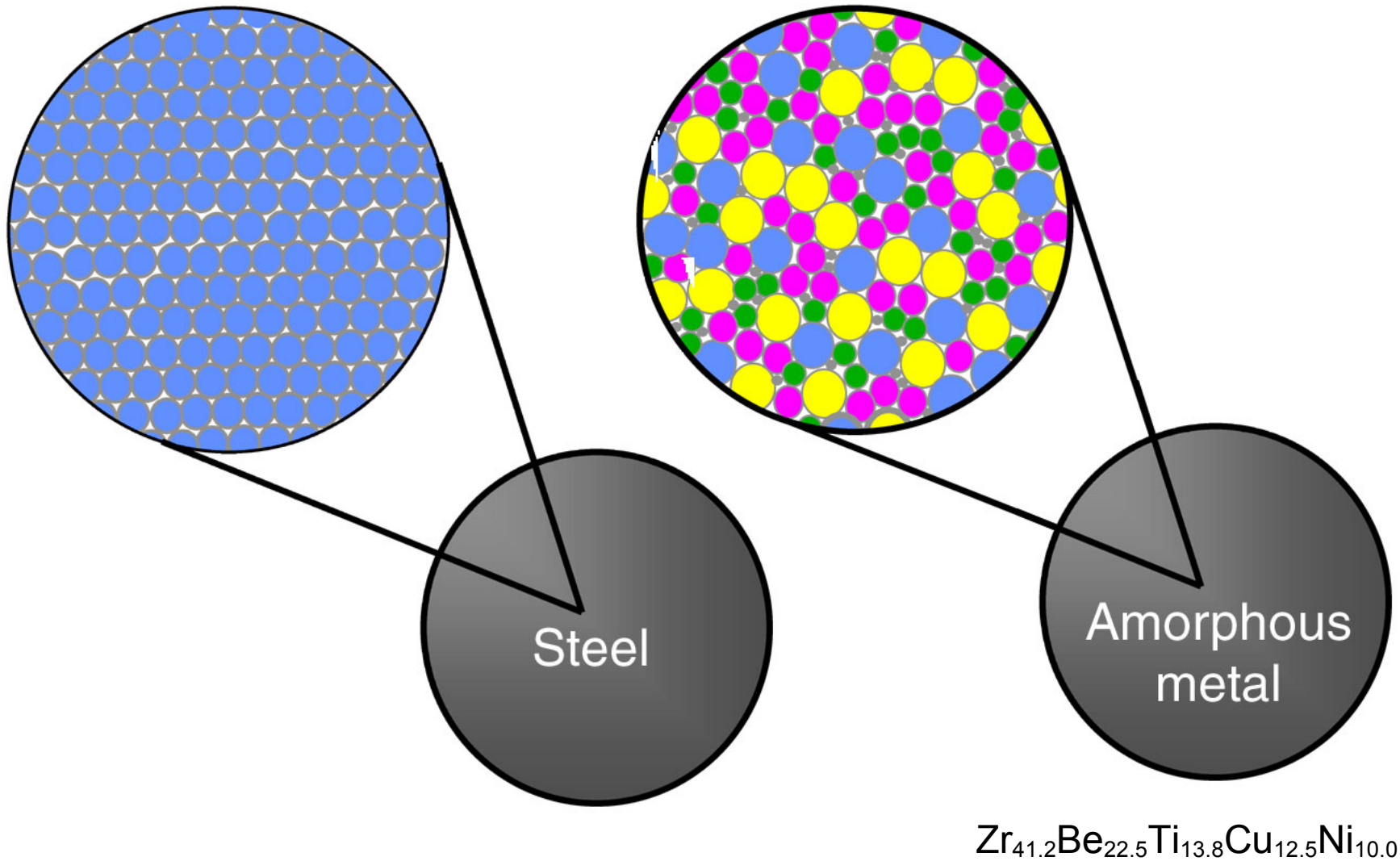


Use your thumb and finger to **touch both sides (the white parts.)**

Have **someone else turn the crank** to make the electrons move.

What do you notice if the high energy electrons move from one side of the material to the other?

**Bounce** the same steel ball on two different metals. Which bounces more?



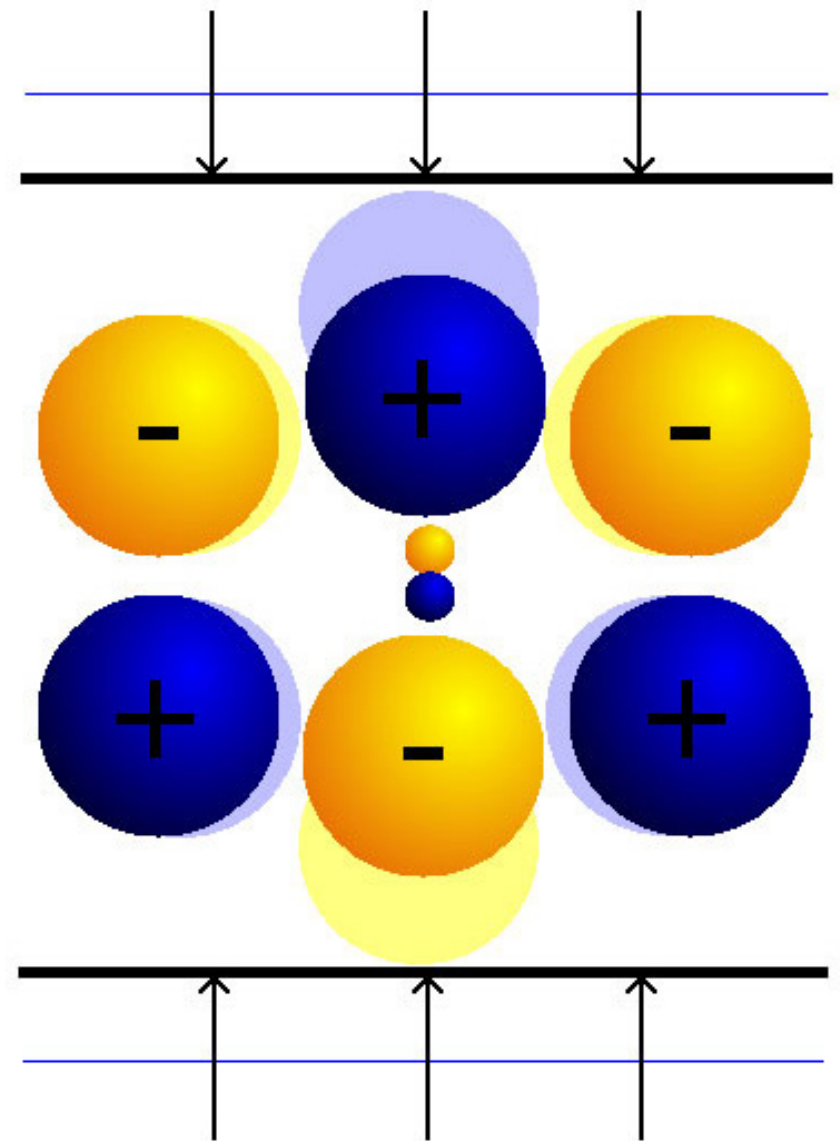
Do things bounce better when hard or soft? **Bounce** two kinds of rubber balls.



*LiquidMetal® alloy is different from conventional materials because of its liquid (or "amorphous") atomic structure. This means that LiquidMetal® alloy does not deform on impact, resulting in 29% more energy return.*

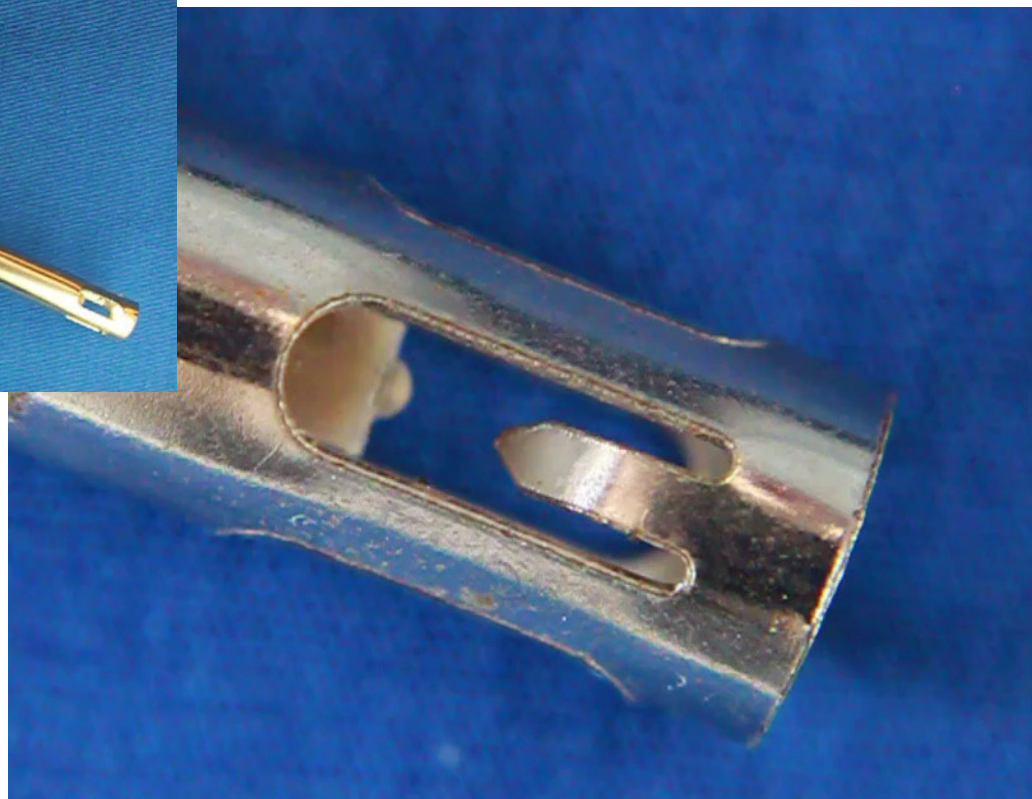
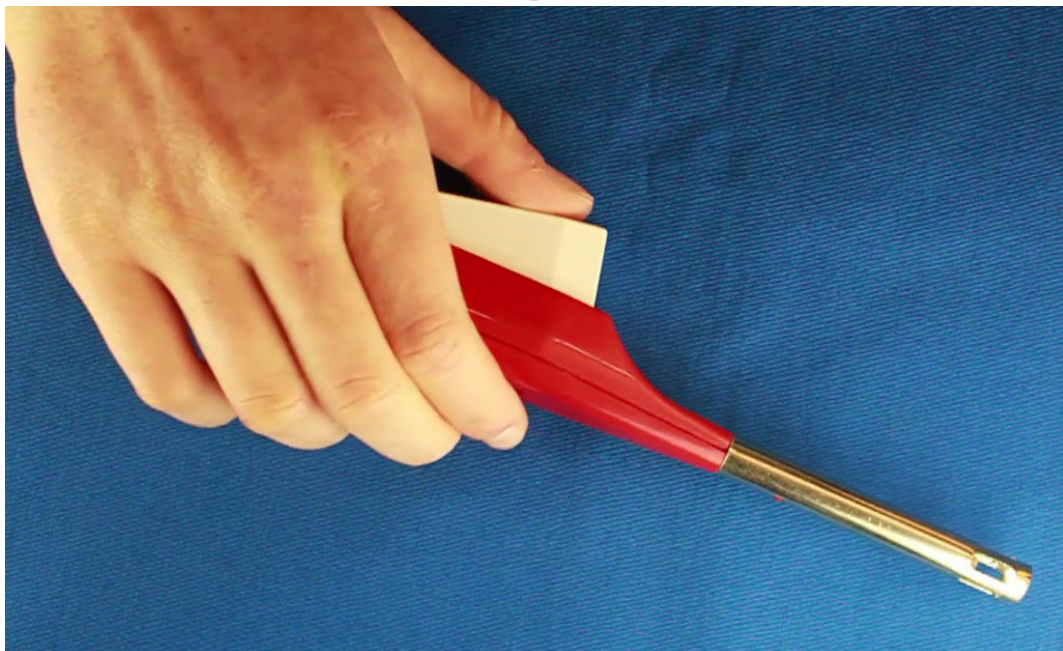
**Tap** on the disk with a pencil eraser.  
Do you make enough electricity to **light** the LEDs? What color light do you see?

There is a piezoelectric ceramic disk between two metal plates. Moving the ions in the disk moves charges and creates electricity. When the ions relax back, electricity flows the other direction. One LED lights during the forward current and the other LED lights during the backward current.

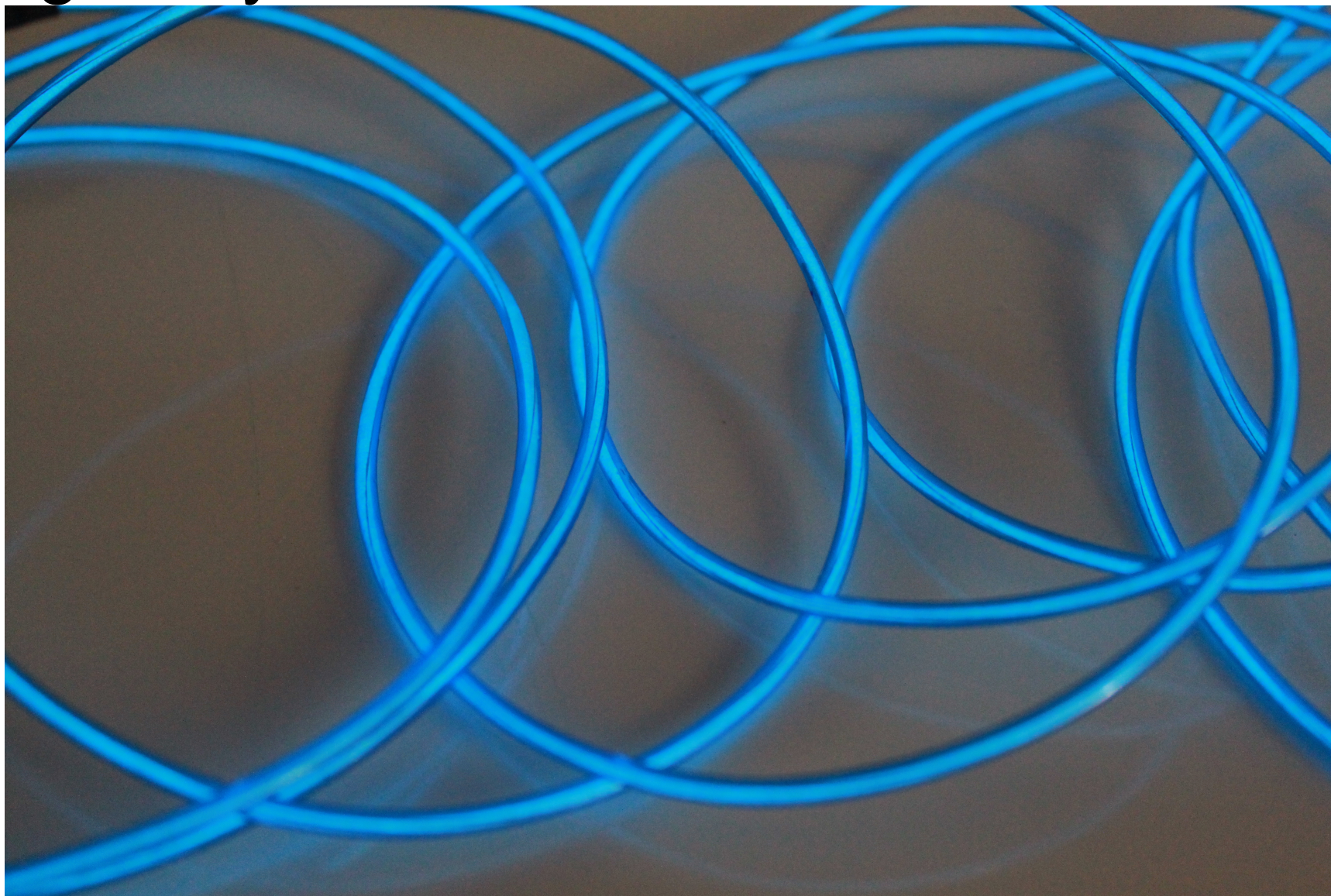




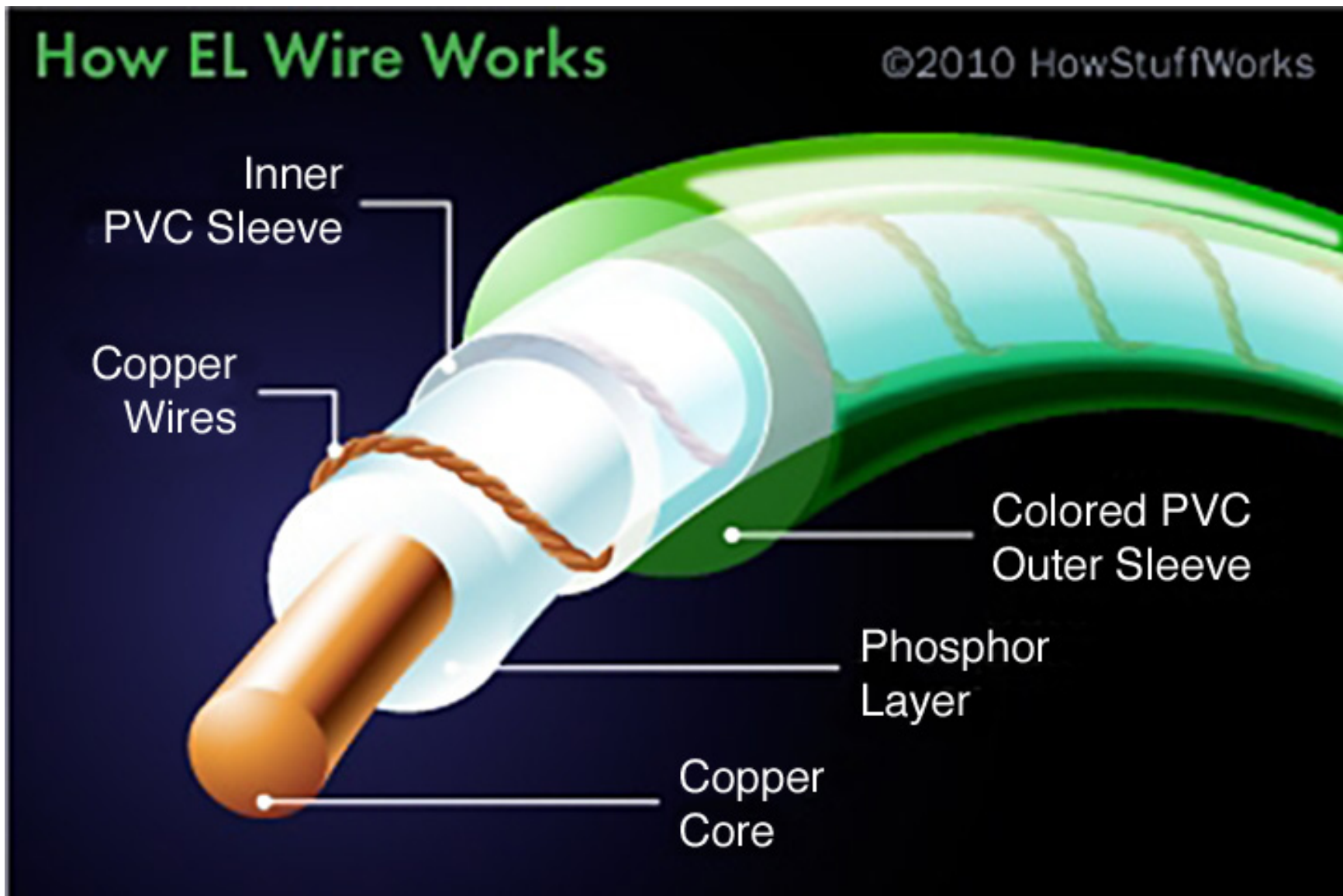
**Squeeze** the barbecue lighter. Do you make a spark? What else could you light with this spark?



**Push** the button. Does this look like the light in your house? What is different?



# Electroluminescence





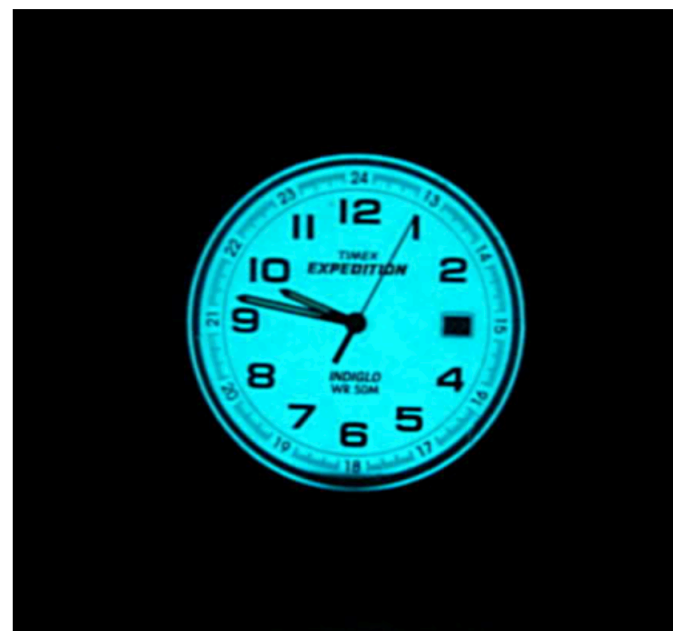
Speedometer



Nightlight



Exit



Indiglo Watch