

# Measurement Sheet

## Lab #8: Doping

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### Experiment #1: Self-Assembly

Pour a portion of the 1:1 Ni:PDMS mixture into one of the small petri dishes. Place a magnet underneath the dish and observe how the mixture moves with the orientation of the magnet. How could this property be exploited to make a practical device?

### Experiment #2: Electrical Conductivity

You have prepared and cured three different PDMS mixtures into rows of pellets: 1) plain PDMS, 1:1 Ni:PDMS, and 4:1 Ni:PDMS. For each pellet, measure the resistance across the pellet using two strips of copper tape and your multimeter. Record how the resistance changes before and after you squeeze the pellet.

↓PDMS Mixture	Resistance (uncompressed), $\Omega$	Resistance (under compression), $\Omega$
Plain PDMS		
1:1 Ni:PDMS		
4:1 Ni:PDMS		

### Experiment #3: Thermal Conductivity

- a) You have also prepared and cured thermochromic PDMS mixtures into a row of pellets. Place thermochromic pellets on the top of PDMS/Ni:PDMS pellets and heat them up with a hot plate (50°C). Observe which PDMS/Ni:PDMS pellet heats up fastest. What does this tell you about their thermal conductivities?

↓PDMS Mixture	Time to change color of thermochromic pellets (sec)
Plain PDMS	
1:1 Ni:PDMS	
4:1 Ni:PDMS	

- b) Place PDMS/Ni:PDMS pellets on a hot place and for each pellet, measure the temperature difference across the pellet at steady state using thermocouples. What are the ratio of thermal conductivity among PDMS, 1:1 Ni:PDMS, and 4:1 Ni:PDMS?

↓PDMS Mixture	Temperature of hot plate (°C)	Temperature of top surface of pellet (°C)
Plain PDMS		
1:1 Ni:PDMS		
4:1 Ni:PDMS		

## Follow-up Questions:

- Silicon and germanium become good insulators at very low temperatures and good conductors at very high temperature. Do you agree? Explain.
  
- An isolated zinc atom has a ground-state electron configuration of filled 1s, 2s, 2p, 3s, 2p and 4s subshells. How can zinc be a conductor if its valence subshell is full?
  
- What are the differences between doping and alloying?
  
- To achieve thermochromism, there are the two basic approaches: liquid crystals and leuco dyes. What are the differences?
  
- How does thermal fax paper work?

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