NNIN
Nanoscale Science, Engineering & Technology

Student Worksheet or Guide

Semiconductors-Doping to create a semiconductor: changing conductive properties through diffusion

Introduction Your teacher will provide you with a handout or direct you to one of these websites for an introduction on how semiconductors are made -- HowStuffWorks at http://electronics.howstuffworks.com/diode.htm or Intel at http://www.intel.com/education/makingchips/preparation.htm. In the semiconductor industry scientists take advantage of the properties of diffusion to introduce atoms into a silicon wafer to change its conductive properties. This process is called "doping" in the electronics/semiconductor industry. Being able to diffuse the atoms is important in making your electronic devices from cell phones to IPods.

Materials

1. Petri dishes prepared with gelatin and water (Directions follow under advanced preparation)
2. Phenolphthalein solution
3. Clear plastic re-sealable bag
4. Dropper bottle of ammonia
5. Student work sheet
6. Background information material or Internet
7. Timers or stop watch
8. White sheets of paper
9. Metric rulers
10. Background information from Internet on making semiconductors.

Make a Prediction

Will you be able to determine that ammonia is diffusing? If yes how?_____

_____

_____

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Conduct an Experiment

1. Place the uncovered Petri dish inside a re-sealable bag with the lid upside down next to it. (You will drop the ammonia droplets into the lid)

2. Place a few drops of ammonia on the lid. Seal the bag which now contains the Petri dish with indicator and the upside down lid containing a few drops of ammonia. Allow for diffusion to take place for three minutes or until you can no longer see changes in the gelatin.

3. Place the bag on a piece of white paper on the lab table and continue to make observations ever 3 minutes. Record on table below.

4. Carefully remove the Petri dish and measure the depth of diffusion. Record.

Record your Observations

Time	Observations
3 minutes	
6 minutes	
9 minutes	
12 minutes	
depth	

Analyze the Results

1. Did you observe what you predicted? Explain.

   _____

   If not, how did your observation differ from your prediction?

   _____

   _____

   _____

2. Did you have a control group? If yes, what was it? If no, how would you make one?

   _____

   _____

   _____

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3. Do your observations leave you with any more questions? Do they enable you to make more predictions? If so, what are they?

4. What color does the phenolphthalein indicator turn from the ammonia mixing with the gelatin?

Draw Conclusions

5. Allow the Petri dish to set out in the open. What happens? Why do you think the color change disappears?

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