



Classroom Lesson Development

Title of Lesson **Transferring Newspaper Print to Polymers**

RET Project Connection The Transfer of Polyaniline to Flexible Substrates
University of Massachusetts - Lowell
Plastics Engineering
Principle Investigator: Dr. Carol Barry

RET Teacher Mark Lawrence
School Dover High School
Town/District SAU 11, Dover NH
Subject(s) taught Chemistry

Subjects covered in lesson Properties of Polymers

Grades appropriate 11-12

Lesson duration Two separate 50 minute lab periods with about twenty minutes the day before and 30 minutes the day after. It could easily be done with just one lab period, but more direction is needed; less inquiry comes out.

Goals/Objectives of lesson Students will show how different properties affect the uses of polymers.
Students can use intermolecular forces to explain everyday phenomenon.

Background information Introduction to polymers and polymer structure including intra and inter molecular bonding. Some experience with polymers is recommended (being able to identify a polymer by its physical and chemical properties)

Essential questions How can we make things stick to polymers?

Links to Frameworks and Standards

National Content Standard B: Developing an understanding of...
The Structure and properties of matter
Motions and forces

State New Hampshire Science Content Standards
Physical Science (PS) Standards
PS2 - Interactions in Matter

8. Students will understand that chemical reaction systems are affected by the physical conditions of the system, including energy, temperature, pressure, concentration, particle size, and solubility.

Local Dover High School Chemistry Competencies
Interactions in Matter (PS2)

Competency 8.

Content Knowledge:

5. Recognize that the rates of chemical reactions can vary greatly, and identify the factors, including energy, pressure, and concentration, that influence these reaction rates.
11. Identify the variety of structures that may be formed from the bonding of carbon atoms, and describe their roles in various chemical reactions, including those required for life processes.

Materials required Sheet samples of PET, HDPE, PVC, LDPE, PP, PS
Newspaper, Hot Plates, Aluminum Foil, Optional IR thermometer
Anything else you are willing to let students use to transfer the print:
Example: solvents (water, alcohol, acetone...), pressure from
books or metal plates with clamps.

Lesson development The day before the lab (about twenty minutes):
Introduce the lab - show examples (if available) and describe the goals of the lab. Have students break into groups (6 groups is about the maximum for the teacher's sanity), assign one polymer to each groups, and start brainstorming ideas for a procedure. Homework could be an the introduction to a lab report.

First day in the lab (~50 minutes):
Allow groups to start experimenting. The teacher will need to circulate to lead groups toward the end safely. I also carry an IR thermometer to measure the temperature of the plastics during the transfer.
For homework - have students research how to make plastics more rubbery/sticky - Glass transition temperature (T_g)

Second day in the lab (~50 minutes):
Get more data. The same as the first day.

Follow up:
Share results. Groups will have different ideas and different results for each polymer. Discuss why - what makes PP so different from PET, or HDPE from PVC?
What has worked for me... Heating the plastic to about 100°C with some pressure is a good place to start. Every polymer is different, so experimentation is necessary.

References Kim B., Koncar V., Dufour C., J Appl. Polym. Sci., 101, 1252-1256 (2006)

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Brydson J., Plastics Materials. 7th Edition. Boston MA: Butterworth Heinemann, 1999.

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