

Lesson Plan: The Chemistry of Reinforcing Concrete

Course: Honors Chemistry

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Introduction:

During the 2003 summer RET at USC, polymers (natural and synthetic) and concrete chemistry were studied. The purpose of the research was to investigate the influence of recycled crumb rubber in a carbon fiber-reinforced polymer (CFRP) matrix. The CFRP was wrapped around concrete columns as reinforcement to improve compressibility. Adding crumb rubber was intended to improve impact resistance. This lesson will involve investigation of the chemistry of many of the compounds used. The goal is to promote interest in materials science in high school students in the chemistry course.

Problems:

1. What are the components of concrete?
2. Explain the chemistry of cement.
3. What types of aggregates are used in concrete and what is the function of the aggregate?
4. What is the structure, systematic name, and source of natural rubber?
5. What is a diepoxy?
6. What is a diamine?
7. Draw the structural unit for an addition polymer produced from a diepoxy and a diamine.
8. How are carbon fibers produced?
9. What is polyacrylonitrile?
10. What is crosslinking?
11. Would you expect a strong chemical bond (or intermolecular attraction) to form between concrete and a polymer produced in question 7? Why?

Lesson Organization:

Students will work alone for 30-40 minutes of class completing internet research on these questions. In order for all questions to be addressed in this short time, students will be assigned to begin at different places in the list. After the internet time, students will work for 20 minutes in small groups (4-5) to discuss their findings. The last 30 minutes of the block will be used for a large group discussion, answering student's questions, and demonstration of RET concrete columns (post-test) to show the real-life application of this information.