

Lesson Plan: The Process of Scientific Research: A First-day Class Discussion

Course: Honors Research I

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Introduction:

During the 2003 summer RET at USC, polymers (natural and synthetic) and concrete chemistry were investigated. 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. The strength of the CFRP/concrete bond was also tested. Two types of crumb rubber were used. They were GF80 and GF170, and were different from each other based on their size of particles. The GF80 had a larger size. Each crumb rubber was added at a 10% level to the epoxy/amine polymer during mixing. The CFRP with and without the crumb rubber were applied to one flat side of concrete bricks and wrapped around concrete columns. Some of the bricks were impacted with a 6kg, one square-inch drop striker that was dropped from 20 feet. Others were not impacted. The bond strength at the impact (or no-impact) site was tested with a pull off tester. The columns were tested for compressibility strength with and without the same impact. Some samples of CFRP (not on concrete) were also prepared and were tested with and without impact for tensile strength.

All of the results indicated that CFRP with and without rubber are statistically equivalent. That is, adding the crumb rubber neither helped nor hindered performance properties of the composite on concrete.

Students in Honors Research I will be required to design, perform, and evaluate experiments to answer a scientific question of their own. The following discussion questions will be used on the first day of class to introduce the ideas of research and help students begin to think about their own research proposals.

Discussion Questions:

What are the steps of research?

Are these steps always followed in order?

What should you do if results are contrary to expectations?

Why is a literature search useful/necessary?

How should experimental data and results be recorded?

How should experimental data and results be reported?

How will you fund your research?

Do you have long term goals for scholarships based on your research experience?

Do you have long term goals for additional research to result from your research experience?

What scientific types of questions have you always wondered about? (Brainstorm a class list.)