STEM Sims™

Heal Thyself

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start right now learning about self-healing materials and how they can help you be safe. Take the following brief quiz to see how much you already know about materials that heal thyself. See the bottom of page 4 to check your answers.

1. All self-healing materials are smart materials, but not all smart materials are self healing.
   a. true
   b. false

2. Which of the following provides the *least* likely application for self-healing materials?
   a. fiberglass car fender
   b. cotton shirt
   c. ceramic bathroom tile
   d. smart phone screen

3. Which substance is required for most self-healing materials to mend cracks?
   a. air
   b. water
   c. catalyst
   d. sunlight

4. Which application technique(s) has been used to dispense self-healing materials to mend cracks?
   a. microcapsules
   b. hollow glass tubes
   c. both microcapsules and hollow glass tubes
   d. neither microcapsules nor hollow glass tubes

5. A good self-healing material for filling cracks must have _____ viscosity.
   a. a low
   b. a high
   c. a moderate
   d. anti-flowing

Get Cracking

A catalyst is a substance that speeds up a chemical reaction. When a material needs to heal itself, a catalyst is required to make the crack mending occur at the proper speed so the crack refills as completely as possible. Below is an activity that you can do at home with the help of an adult to see how a catalyst works.

Hydrogen peroxide is a common chemical found in most homes. The chemical formula for hydrogen peroxide is H_2O_2. Hydrogen peroxide normally breaks down into water and oxygen gas; however, the process usually occurs fairly slowly. A catalyst can be added to speed the reaction up so it's easier for you to see.

Materials that you'll need

one drop liquid detergent
yeast
spoon
3% hydrogen peroxide
small clear plastic cup

detergent

yeast

Procedure

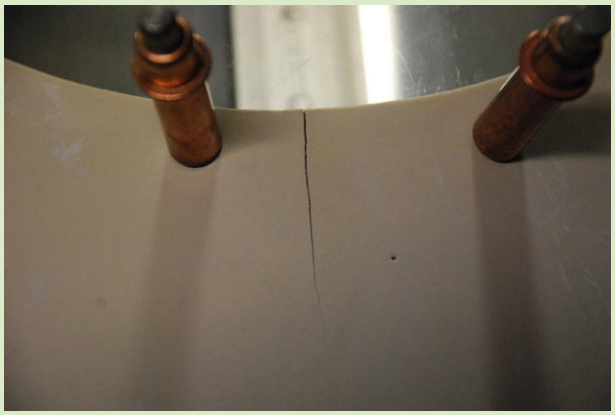
1. Add a small amount of hydrogen peroxide to the clear plastic cup. Just fill the bottom of the cup with the hydrogen peroxide. Observe and record on a sheet of paper what you see inside the cup.
2. Add one drop of liquid detergent to the cup with the small amount of hydrogen peroxide.
3. Add a small amount of water to the cup containing the other materials. Stir with the spoon.
4. Add a small amount (about the size of a pea) of yeast to the cup containing the other materials.
5. Observe and record what's happening inside the cup. Make sure to feel the temperature of the cup with your hand.
6. After the bubbling stops, pour all of the materials down the sink drain, flush the drain with lots of water and properly dispose of the plastic cup.

Some Questions for You

1. What evidence did you observe that indicated a chemical reaction was taking place?
2. How did adding the yeast change the hydrogen peroxide you were observing?
3. What happened to the temperature of the cup after you added the yeast?
4. What do you think was the purpose of adding the liquid detergent to the cup?

Heal Thyself

Slipping Through the Cracks



Material scientists took a page from biological systems when it came to having materials fix themselves when damaged. Scientists have created materials that have the ability to repair the break, just as human skin repairs itself when damaged. Their secret: they place liquid resin inside tiny capsules and embed the microcapsules along with a catalyst in the parent material, such as fiberglass. Then, if the fiberglass cracks (Figure 1), some of the microcapsules are ruptured (Figure 2) and the resin spills out into the crack. The catalyst that is dispersed throughout the fiberglass combines with the resin and speeds up the chemical reaction. The resin hardens very quickly, fills in the cracks (Figure 3), and the fiberglass returns to looking brand new.

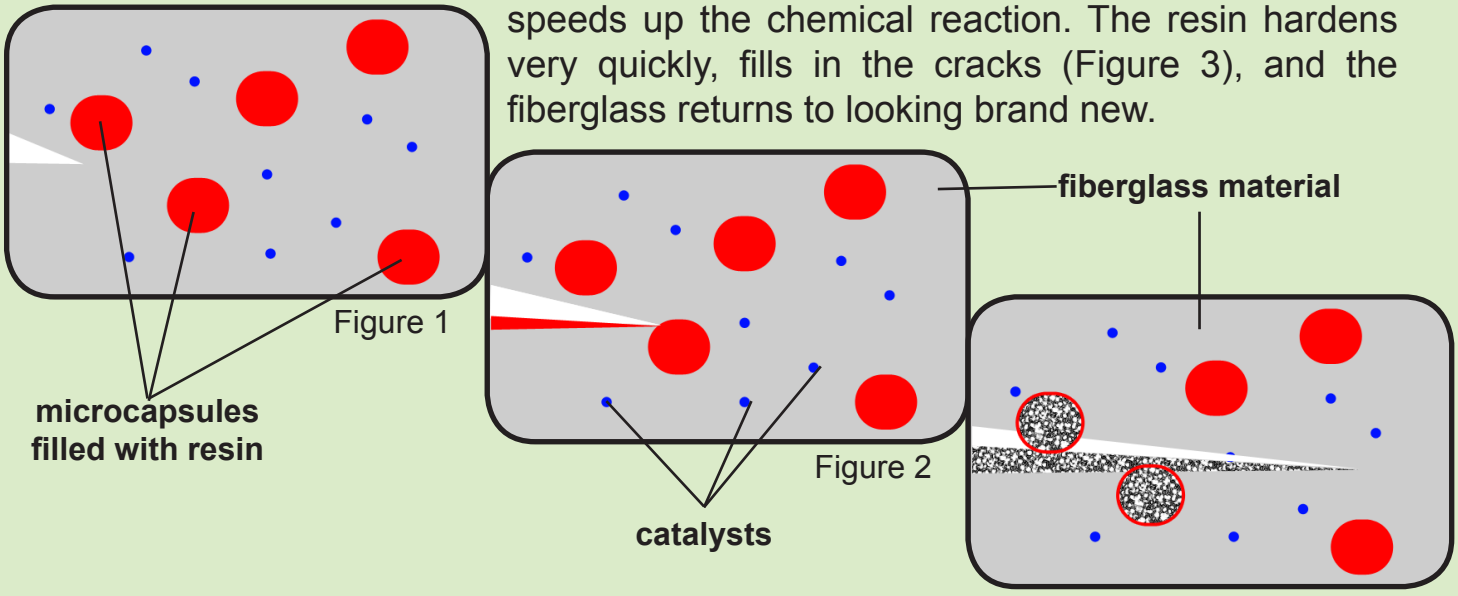


Figure 1

Figure 2

Figure 3

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Answers: Page 2 Answers: 1) a, 2) b, 3) c, 4) c, 5) a.

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