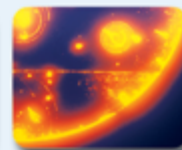
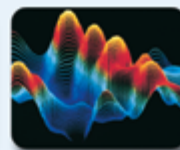


Chemistry in Action



Carbon Monoxide Catalyst

Colorless, odorless, and deadly—carbon monoxide, “the silent killer,” causes the deaths of hundreds of Americans every year. When fuel does not burn completely in a combustion process, carbon monoxide is produced. Often this occurs in a malfunctioning heater, furnace, or fireplace. When the carbon monoxide is inhaled, it bonds to the hemoglobin in the blood, leaving the body oxygen starved. Before people realize a combustion device is malfunctioning, it’s often too late.



Carbon monoxide, CO, has almost 200 times the affinity to bind with the hemoglobin, Hb, in the blood as oxygen. This means that hemoglobin will bind to carbon monoxide rather than oxygen in the body. If enough carbon monoxide is present in the blood, it can be fatal.

Carbon monoxide poisoning can be prevented by installing filters that absorb the gas. After a time, however, filters become saturated, and then carbon monoxide can pass freely into the air. The best way to prevent carbon monoxide poisoning is not just to filter out the gas, but to eliminate it completely.

The solution came to research chemists at NASA who were working on a problem with a space-based

NASA’s space-based carbon dioxide laser needed to be fed a continuous supply of CO_2 . This was necessary because as a byproduct of its operation, the laser degraded some of the CO_2 into carbon monoxide and oxygen. To address this problem, NASA scientists developed a catalyst made of tin oxide and platinum that oxidized the waste carbon monoxide back into carbon dioxide. The NASA scientists then realized that this catalyst had the potential to be used in many applications here on Earth, including removing carbon monoxide from houses and other buildings.

Typically, a malfunctioning heater circulates the carbon monoxide it produces through its air intake system back into a dwelling space. Installing the catalyst in the air intake would oxidize any carbon monoxide to nontoxic carbon dioxide before it reentered the room.

“The form of our catalyst is a very thin coating on some sort of a support, or substrate as we call it,” says NASA chemist David Schryer. “And that support, or substrate, can be any one of a number of things. The great thing about a catalyst is that the only thing that matters about it is its surface. So a catalyst can be incredibly thin and still be very effective.”



The idea of using catalysts to oxidize gases is not a new one. Catalytic

converters in cars oxidize carbon monoxide and unburned hydrocarbons to minimize pollution. Many substances are oxidized into new materials for manufacturing purposes. But both of these types of catalytic reactions occur at very high temperatures. NASA’s catalyst is special, because it’s able to eliminate carbon monoxide at room temperature.

According to David Schryer, low-temperature catalysts constitute a whole new class of catalysts with abundant applications for the future.

Questions

1. How did NASA’s research on the space-based carbon dioxide laser result in a benefit for consumers?
2. According to the chemical reaction, if there are 4.5 mol of oxygenated hemoglobin present in an excess of carbon monoxide, how many moles of hemoglobin would release oxygen and bind to carbon monoxide? Explain your answer.



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