"Buckyballs"

By Bill Hobby

Carbon is a basic building block of the universe. It is the commonest element. It is present in all living things. Coal and diamonds, candle soot and interstellar dust, are made of it. The ink you reading right now is made of it.

Who would have thought there was anything new to be known about carbon? Yet few recent scientific discoveries have caused as much excitement as the discovery at Rice University of a spherical molecule of carbon called the "buckyball."

Thousands of new materials may evolve from a flurry of research in buckyballs. They may revolutionize the way we use electricity, fuel space flight, and lubricate our machines.

The name is condensed from "buckminsterfullerene," after the architect and inventor Buckminster Fuller. Fuller designed the geodesic dome, which buckyballs resemble. They also resemble the 20 hexagons and 12 pentagons on a soccer ball.

Their spherical shape makes buckyballs special. Because of their closed shape, buckyball molecules are extremely stable, unlike other carbon materials. Scientists at the University of California are firing buckyballs into metal barriers at high speeds. Instead of breaking up like other molecules, buckyballs tend to either bounce off the barrier or to penetrate it. Hence the talk of eventually making bulletproof vests. (And presumably, someone will want to make buckyball bullets as well.)

The hollow shape of buckyball allows scientists to drop another element inside the molecule. They call this "doping" the fullerene.

All over the country scientists are busy doping fullerenes with all sorts of elements, creating new materials with many possibilities.

Superconducting scientists such as the University of Houston's Paul Chu, are interested in the material. Buckyballs doped with potassium become superconducting at extremely low temperatures. By prying the tops from the spherical clusters, scientists can make carbon tubes or filaments, an important requirement for making practical superconducting materials.

Buckyballs have other attractive properties. Under extreme compression, buckyballs become as hard as another form of pure carbon--diamonds. Scientists think that molecular sheets of buckyballs would change semi-conductors. Bucky's extreme resilience makes it a candidate for rocket fuel, which must withstand huge pressures.

And like graphite, the only other known form of pure carbon, buckyballs may have many uses as a lubricant. The round molecules may work even better than graphite to reduce friction.

Buckyballs could as well be called "Smalleyspheres". They were discovered almost by accident by Rice University chemist Richard Smalley. Smalley had built a laser beam apparatus with which he studied large, highly reactive clusters of atoms that don't ordinarily

appear in nature. The device aimed a short, ferociously hot beam of laser energy at a material, then sucked it into a condensing chamber where it cooled.

In 1984 the British scientist Harry Kroto asked Smalley to blast carbon with his device. Kroto was interested in the makeup of long chains of carbon molecules found in space. On a small scale, the intense heat of the laser would replicate the heat formed by the convulsions of dying stars.

In August 1985 Smalley and his team of graduate students blasted some graphite. They found Kroto's long chains of carbon atoms, but they found something even more unusual: the persistent appearance of a molecule with 60 carbon atoms attached to it.

The new molecule excited more skepticism than enthusiasm at first. But scientists at the University of Arizona discovered a way to make buckyballs cheaply, using a Sears arc welder and some graphite rods.

Buckyballs have now been photographed with electron microscopes. They have been featured on the covers of most of the general science magazines such as Scientific American, Nature and Discovery.

Smalley was able to predict what the molecule would look like because, inspired by Kroto's memory of a geodesic dome he had built for his child, Smalley sat up late one at night cutting out hexagons and pentagons and taping them together.

The result was something like a sphere with 60 corners, one for each of the carbon atoms. Buckyballs were discovered.

It was about time. Buckyballs may be among the oldest and most common molecules in the universe, created by the heat of red giant stars 10 to 20 billion years ago.

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