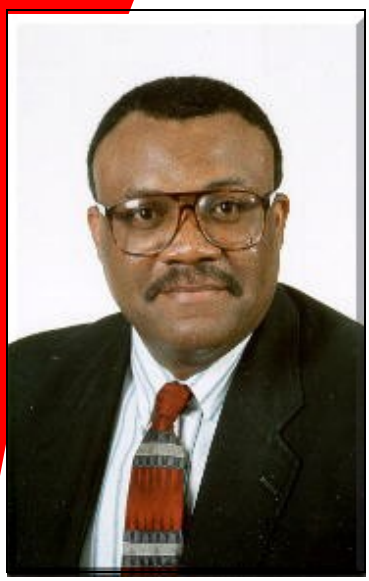
A Tale of Two Plastics



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Chris Ibeh (pronounced e-bay) followed his curiosity.

He grew up in Nigeria, Africa's number one oil producing country. Back in the 1960s before environmental regulations, natural gas that came up with the oil would be burned to get rid of it. Often at night 13-year old Chris and his friends would watch the sky glow reddish-yellows because of the flames burning several miles away on offshore oil wells. He asked himself, "What is this? What is going on?"

This exposure to the oil and gas industries led him to degrees in natural gas engineering at Texas A & M and chemical engineering (energy) at Louisiana Tech University. In the 1960s plastics were the new big thing. "What is this thing they call plastics?" he wondered. When he found out plastics are made of oil and gas, his interest increased.

Fast forward and today Dr. Chris Ibeh is a professor of plastics engineering technology at Pittsburg State University in Pittsburg, Kansas, where he has been for the past 20 years. He is also director of the Center for Nanocomposites and Multifunctional Materials (CNCMM) there.

Most plastics are made of carbon derived from oil or natural gas. These raw ingredients are made up of hydrocarbon molecules, which contain one or more carbon atoms to which hydrogen atoms are attached. Plastics are polymers—large molecules made up of repeating patterns of smaller molecules (monomers) that are bonded together by a chemical reaction called polymerization. A polymer (many parts) is like a chain in which each link is a monomer (one part). During polymerization hundreds or thousands of monomers combine together to make polymer chains. Millions of these chains form and are known as polymers or plastics resins. Additives are combined with these resins, which are usually in a dry powdered or pellet form (and sometimes in liquid form), to make the desired material and be formed into products like our cell phones.

One cutting-edge research project he and his colleagues are working on is for the U.S. Navy. He is trying to develop materials that can withstand explosions. Plastic composite materials are lighter in weight than metals or ceramics which can weigh four times more than plastics. Plastics do not oxidize or rust. He is working on developing a plastic that is explosion resistant and is fire proof. "This is the unique thing about what we are doing," says Ibeh. "In a crash, most casualties are not from the crash. Most come from the fire, smoke and toxicity. If we want to make good explosion-proof materials, we want to start from the beginning and make it fireproof."

There are two types of plastics—thermoplastics which are recyclable and make up 90% of all plastics. And thermoset plastics which are used as binders to other materials to make composites. This is where Ibeh works on levels smaller than the polymers-- in micro and nanotechnology. (A nanometer is a billionth of a meter.) Dr. Ibeh is trying to come up with the recipe for this fireproof, explosion-proof material. It's about the chemical changes that take place between the materials and the results. As in a recipe, it is the formulation of the chemicals that is important. "If we are successful we will have a suitable material to compete with metal and ceramic and give the Navy the best value for their money," says Ibeh.

Dr. Ibeh says today global competition is real and it doesn't matter where you live, in Singapore or Mexico or Kansas, learning math and science is very important. For those interested in science, Dr. Ibeh has some advice. "It helps to pay attention in class. You need that preparation so you can understand what you are interested in."

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