Material Magic - Making Diamonds: Crash Course Kids #40.2

Physical Science
https://youtube.com/watch?v=MraHoI-Yik4
https://nerdfighteria.info/v/MraHoI-Yik4

[intro plays]

Sabrina: You can't make something from nothing. I mean if you could, you'd see me surrounded by an unlimited supply of Harry Potter books and Jolly Ranchers right now. But what you can do is take some stuff and change it to create what's basically brand new stuff. Well I can't, but material scientists can.

Last time we talked about how scientist can improve existing materials by altering their properties, like turning glass into super extra hard gorilla glass, but they can also make new materials. So today we'll find out how and why scientists can make materials with whatever properties they want.

[text: Big Question]

But first, let's do some review. We all remember what a material is, right? A material is an object made of matter. All materials have properties, a property is a distinguishing quality of a material like its color, shape, size, or weight. And material scientists study the properties and uses of different materials and invent completely new ones.

Think of a material that we use all the time like rubber or plastic. Chances are at some point in history it might not have existed until a material scientist invented it. And more often than not, materials are made to solve a specific problem. Let's take a look at a real-life material that's been made by scientists to have the properties that they wanted in order to solve a problem.

[text: Investigation]

This is a diamond. Sparkly. These are also diamonds. In fact in a lot of ways these diamonds seem to be pretty similar. They're both materials, or objects made of matter, but one of these materials was made naturally, deep inside of the Earth. The other was made in a lab. That's right, we can grow diamonds in a lab. Well maybe, not "you and me" we, but material scientists can and do make them.

Natural diamonds are formed deep in the Earth, far below the surface. This part of the Earth is super hot, there's also a ton of pressure there with the weight of all of that rock above pressing down. This combination of high temperature and high pressure pushes atoms of the element carbon together to form diamond crystals. Their hardness and sparkliness are two of the main properties of diamonds that make them different from other forms of carbon like graphite or coal.

So when people want diamonds, do they just drill down into our planet and start picking up their favorites? Um, no. Diamonds are cool and all but that would be a lot of work. The diamonds that we see on jewelry and such are the ones that have been brought closer to the Earth's surface by violent eruptions a long time ago. This means there's a limited supply of diamonds in the world. This is a problem because diamonds are not only pretty, they're also really useful. Namely, diamonds are some of the hardest substances on the planet, so they're super handy for cutting through or polishing surfaces that would break almost anything else. Tiny diamonds are actually used in some kinds of saws and drills that can cut through rock and even concrete.

But since natural diamonds are really rare, they're also really expensive. So a bunch of clever scientists figured out a way to make their own diamonds without having to spend weeks drilling into the Earth. One process for making diamonds in a lab is called high pressure, high temperature or HPHT for short. This process basically tries to replicate what's happening deep within the Earth using just a key natural material called graphite.

Scientists place graphite, a soft, grey form of carbon and the stuff that you can find in your number two pencil, under intense pressure and heat. Heavy blocks in the HPHT machine press down on the graphite creating pressure while a zap of electricity creates the high temperature. The pressure and temperature start to change the properties of the carbon, and BOOM in just a few days a hard, sparkly diamond is created. Of course jewelers would need to cut it to get that classic diamond look, but even in its pure form you can see that it's clearer and much harder than the original graphite. That's how one material, lab-grown diamonds, went from a form of material with completely different properties to a form with the properties we wanted.

[text: Conclusion]

Humans can make materials using basic natural elements like graphite when they really need to solve a specific problem. There are also tons of other examples out there of materials that people have created like rubber or plastic or nylon. None of those things existed until some intrepid scientist started thinking and fiddling. Who knows what brand new material we'll cook up next. I know lab-grown diamonds are hard to outshine, but I think we're up to the challenge.

[endscreen]