Transcript: The Hot Drink Can

Lecturer: This is what the can looks like inside. Now, I'll just talk to you now a bit technically - about how it all works. You can see that in the can you've got an area for coffee, you've got an area for the chemical reaction which we've done and you've got a widget at the bottom which starts off the chemical reaction so it doesn't just all happen at once. It's in controlled fashion and then there's all kinds of things all the way round it. Now I want to talk to you about how that invention was made.

It started off by a request from a small company to the University: Is there anyone who can tell us how to make and develop a hot coffee can? And two of us put our hands up and said: Yes. We can do it. And we went on and did it. And how did we do it? Let's look at the inside. What are the design features of that hot coffee can? We want a simple, safe, cheap means of generating a lot of heat, and my job in the partnership to make this product work was to talk about the chemistry. (Aside: How are your little bottles doing? Are they still hot? Bottles still hot? You see, they're still making heat.) So my job, you see, was to develop the chemistry of the reaction to make it into a product. So here is what we had to do.

We had to find a cheap means of generating lots and lots of energy. So we went to the library and looked up all the chemical reactions which made heat. And those reactions are called exothermic reactions. There is another family of reactions which are called endothermic. If I wanted to make a cold can I would use an endothermic reaction, and those are the two types of chemical reaction which are useful. So we found then that the cheapest reaction and the simplest reaction was one involving quicklime and water. So quicklime reacts with water and gives the slag-lime.

And here's the next part of the technical side - it' s calcium oxide with water giving calcium hydroxide - and to get really technical - it's calcium oxide written in symbols, with water and calcium hydroxide and heat. And the important part of this is that most chemical reactions, when you read them in the books, miss out the heat business and that's a really important thing for us. Now, we want it to be safe and quick to transfer the heat to the drink. Now we did that as you saw in the - in the can. If I go down to this bottom corner… Here we are - we've got… the chemical reaction is confined to this area here so you don't get your coffee all mixed up with horrible gritty - gritty solid - as part of your drink. So, that was an important part of the design.

And we want a product that does not harm the environment. Now quicklime is a known agricultural chemical that farmers put on their land. Slag-lime is a garden chemical which we use lots and lots in the garden centres, so the two components of our can are quite safe. And it means when we recycle the product then there is no danger or difficulty in recycling the product in the environment. I was responsible for the chemistry and my friend here, Neil Richardson - he's an engineer - and he worked on how the design of the can was to be made.

Let's talk a bit more about the chemistry; how much quicklime and how much water? Well, you can do this by a theoretical calculation - by saying what are the atomic masses of water, of hydro[cough] with a bit cut off, of water and calcium … what are the atomic masses of calcium oxide and water and how much heat do you get out? These are the parameters we have to deal with. This amount of heat had to do with the temperature we had to raise the drink can to, to give a nice warm drink. We decided the can should reach (at) about sixty degrees centigrade, from room temperature. So, the heat there - the carriers there - had to be able to heat up the whole system from room temperature to sixty degrees and those of you who've got little bottles of water and calcium oxide may wonder well how is it going to work? Well it does, it does work and we can get the temperature. But in practice, when you think about this whole situation not all…..it depends on the reactivity of the lime and the volume that has to be heated and that's what I've been talking about. And we settled on the fact (that) the volume of drink should be about 200 mils - which left inside the can about 100 mils for the chemical reaction - because we decided that this was going to be the model for our hot drink can.