Microstructural Characterisation of Cementitious Materials
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Interview with Professor Karen Scrivener

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(Professor – Professor Conversation starts)

Professor Ravindra: So we have Karen Scrivener with us. She is a Professor at E P F L in Lausanne, Switzerland and according to me she is really an authority on microstructure, cement chemistry and material science of cement-based materials and concrete.

And I admire her a lot for her determination and tenacity. And more than anything else, for trying to make science easy enough for people to understand even in industry, because she does not stick only to her lab space but she talks a lot with industry.

And we are very happy to have her in India many, many times every year. She is, she is obviously a leader in her field and she is the reference person that we can go to when we have problems or doubts in material science.

She has also brought to put together a network called Nanocem which has done a lot to propogate and bring together people who work in nano and micro analysis and understanding of materials.

She is heading a major project that we are happy to be involved in which is L C 3 which is on limestone calcined clay cement and there really she is going the whole stretch from the understanding of the microstructure to looking at how such a cement can be implemented and used in practice.

So Karen, welcome.

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Professor Karen: Thank you very much.

Professor Ravindra: And we are really grateful that you could give some lectures to our students. So one thing I would like to ask is why material science is important? Or why should, or how should we encourage people to get into material science of concrete?

Professor Karen: Well, I think it is really important for looking at the challenges we have today. I mean, may be if we had unlimited resources, unlimited energy and no problem like global warming it would not be so important.

We could just continue to use materials in the same way we have been using. But we know that, you know, all materials concrete included, we have productions of C O 2 which is contributing to global warming.

We are running out of materials and if we are going to tackle these challenges we have to look to the materials and how we can use these materials better. So I, we always say how we can do more with less?

And if we have got to move with less then we really have to understand what is behind the way these materials behave, which is material science of these materials.

So I think it is very much in today's context that we have these, these limitations that we need material science to better answer them.

Professor Ravindra: Certainly. And I think, and I expect you would agree that our curriculum also has to change

Professor Karen: Yeah

Professor Ravindra: Because we have been looking at structural design as the backbone of...

Professor Karen: Yeah

Professor Ravindra: the, how we deal with the concrete in the curriculum. We do not talk much about the material science, the chemistry and what, what is the basic building block...

Professor Karen: Yeah

Professor Ravindra: And that probably also has to change in the curriculum how we teach.

Professor Karen: Absolutely. I mean 20 or 30 years ago, the only type of cement anybody could buy was ordinary Portland cement which was pretty much the same wherever you were.

Now you got to trace of , do you use suppose a Layrite cement, do you move towards L C 3 cement, do you stick with Portland cement and how can you possibly make a firm decision on that if you do not understand what the differences are between these different materials?

So it is, again you know, for going to have any chance of meeting these challenges facing us, we have to educate our civil engineers differently so that they understand this. And you know, I do not think it is that difficult to do.

I mean, we have intelligent people who can do very complicated mathematics and structural equations. I do not believe those same people are not capable of understanding the basic chemistry. It is just the question of education and giving them the right information.

So I really hope that, you know this kind of lecture like we are doing here, kind of make some contribution to that.

Professor Ravindra: Well, you have been working on this for a long time. We use some of your graphs and images and pictures in our classes.

Professor Karen: Yeah

Professor Ravindra: From going back to your Ph D work. Now have things changed a lot in ap (()), have people appreciated more that you have to bring about this understanding?

Professor Karen: I think so. I mean, I think, this too, well there are several components to that. First of all, I think we are really making a lot of processing progress in getting to the bottom of the underlying mechanism.

So whereas as 20, 30 years ago we could have said we do not really know what is really happening here. Now we really know what is happening. Secondly by the creation of Nanocem we really brought together the industry and convinced them that they need to invest in this fundamental research.

And I think that had two consequences. First of all, it has given funding to enable us find out lot of these mechanisms.

But secondly, the industries themselves have become very much more interested in, in the analysis, and a lot of the people we have trained in Nanocem for Ph Ds have now, are now in the industry and that also helps the, you know tremendous increase of knowledge I think we see.

Of course it is a long way to go because that is a sort of thing, the trend we started (()) in Europe but that needs to spread more widely. We have to work on changing curriculum; there are still many more things to do. But I think, I think we are making progress.

Professor Ravindra: Lot of times when we go to funding agencies, they say what is new in cement and concrete?

Professor Karen: Yeah

Professor Ravindra: We have done it before. Everyone knows how to do it. So is there a short answer or is there a way to convince people that there is a lot to do? Obviously we believe in it but how do we convince?

Professor Karen: I think more important, then it is not lot to do (()), we have to convince people that there is no miracle out there.

Sometimes, you know I think that people have the illusion that because we see such rapid advances in things like microelectronics and things like that. There is some kind of miracle solution is going to come and solve everything.

But when we are talking about solid materials we are really confined by the composition of the earth. And we cannot change that. So there is no miracles out there. And we know what is in the earth. We know what are the possibilities to do.

So funding agencies have to appreciate that you have to work in an, in reality. You, it is not, you know, we knew, we discovered 400 years ago that alchemy was an illusion. You cannot turn base metals into gold. Or at least not without a nuclear reactor which we are not really going to be interested in.

So we have to work with real materials and therefore it is more important to go deeper with materials which we were using already than to think that some, you know, some magic potion is going to come along which is certainly going to solve everything.

And I think that is kind of difficult for funding agencies to realize that even though you are sticking with the same basic materials you can still make considerable improvements.

Professor Ravindra: Would you make a prediction on how long or how many more years we will continue to use cement and concrete...

Professor Karen: Well...

Professor Ravindra: as the most important construction material that we have?

Professor Karen: (laugh) I do not think there is any, you know, I can be absolutely 100 percent sure I will be right on this. It will continue to be the most used material forever because there is nothing that can replace it on the scale we need to house people.

So you know, it is, it is difficult for people to understand this but there really is no alternative that can enable us to live in cities with motorways and everything like that as we do in the modern world. If we want to go back to living in that mud huts well there we would not need cement and concrete.

But I think most of us do not really want to go back to live in mud huts however romantic it may seem occasionally.

Professor Ravindra: So having said that, where does L C 3 fit in?

Professor Karen: We L C 3 is really I think is something with tremendous potential to meet these challenges both of global warming of C O 2 and resources. We can continue to really make substantial cuts.
I think we can realize and now the at least probably another 20 to 30 percent reduction in C O 2 emissions worldwide, 20 to 30 percent emissions on cementitous sector would be equivalent to 1 or 2 percent of all the emissions that, of everything (()).

So that is pretty significant when you consider the amount that is coming from the electricity production and everything.

Secondly it can help us meet this resource challenge because the world, you know we have lot of limestone for example. But there is increasing resistance throughout for new quarries.
Of course people do not want to; they want land to build on, or for agriculture. They do not want it for, for exploitation in quarries.

And with L C 3 we can, we can reduce the amount of limestone needed for making the clinker and we can also get rid of lot of materials that are in (()) 0:10:10.6 part of waste. We have huge spoil heaps in clay quarries that at least can be reused in cement. We can also get rid of another problem and rehabilitate those other quarries.

Professor Ravindra: Thank you very much, Karen, always a pleasure talking to you.

Professor Karen: Well, thank you Ravindra. It is a pleasure to be here as always and hopefully they will get something from these lectures.

Professor Ravindra: I am sure they will. Thank you.

Professor Karen: Thank you

(Professor – Professor Conversation ends)