LIVIA RIBEIRO DE SOUZA

Co-Founder and Chief Technology Officer at Mimicrete Ltd.

Lucia Sinapi-Thomas, Executive Director of Capgemini

Let me turn to Livia Ribeiro de Souza, the co-founder and Chief Technology Officer of Mimicrete, a spin-off from Cambridge University. You are working on a self-healing concrete solutions, so again inspired by nature, please tell us more.

Livia Ribeiro de Souza

To begin with, thanks for the invitation to this event, I am very flattered and good afternoon, everybody. Bear with me for a little bit of science this afternoon, but we are going to start talking about why there are so many cracks in concrete. Concrete is commonly used not only because it is widely available, but also because it is very good under compressive loads, but not as good under tensile load. This is why we typically place rebars inside concrete to balance out those tensile forces. However, if small cracks are formed contaminants can enter the concrete and corrosion can take place in the rebars. That is why when you go to coastal areas you can usually see much more corrosion and corroded surfaces. Also, during the winter in the UK they put salt on the roads and that chloride can escalate the corrosion process. As a result, substantial amounts of money is spent on repair and maintenance and that is a problem because then, as we all know, cement is one of the fundamental materials used in the production of concrete and cement production produces around 7% to 8% of CO2 emissions during the calcination process. There are numerous projects to use less cement, with materials such as calcined clays or blast furnace slag, but there is still no clear alternative quite yet. With population growth we know that the use of concrete is just going to increase and also that 37% of CO2 emissions are associated with the total built environment, together with maintenance and repair actions.

In the past 10 years or so at Cambridge, we have been investigating self-healing technology for cementitious materials, mimicking what happens in nature. If there is a scratch on a tree or our own skin, our bodies and nature have that intrinsic self-healing capacity. We can learn from nature and apply this ability in our infrastructure. We are doing it by embedding healing agents into the infrastructure, either in discrete elements such as capsule or in continuous systems like the vascular system, which delivers the healing agent. As a result, we can extend the service life of the infrastructure and decrease all the actions that could be associated with its repair and maintenance. We have tested that system in the lab, and it has showed a lot of potential, but we started Mimicrete to investigate pathways to commercialise that technology, particularly focusing on scaling-up and establishing partnerships to de-risk the technology in application in the relevant environment.

The results we see with this kind of technology are two-fold. On one side we can see the decrease in actions associated with repair and maintenance. On the other, if we go back to why rebars or steel are needed in concrete, by enhancing the capacity of concrete to heal itself and to close those cracks by itself, we can reduce the amount of steel used. We have reports that show we can reduce the amount of steel by 35%, which is quite a large figure in terms of sustainability. We are also keen on investigating how we can decrease the amount of cement that is needed once that self healing technology is deployed.

Lucia Sinapi-Thomas

That is absolutely astonishing, minus 35% steel and longer duration for the material itself, a wonderful example of a new approach and how innovation can help with sustainability. These two examples are part of the biomimetic technologies that are impressive because they are inspired by nature.