



Dr. Reza Javaherdashti, Head of Corrosion research.

A passion to combat microbial corrosion

An interview with Dr. Reza Javaherdashti of Eninco Engineering

Dr. Reza Javaherdashti is passionate when it comes to corrosion, and methods to avoid it. This is perhaps not surprising since he has a Ph.D. in corrosion and an extensive background in metallurgical engineering and material science. In his daily work, he is General Manager at Eninco Engineering, a company well-known for its consultancy regarding protective and anti-corrosion coatings, which are used in a wide variety of industries. We recently sat down with him virtually to discuss some aspects of his work: the dangers of microbial corrosion, what Eninco is doing to combat it, the significance of the research, and why attending conferences is important.

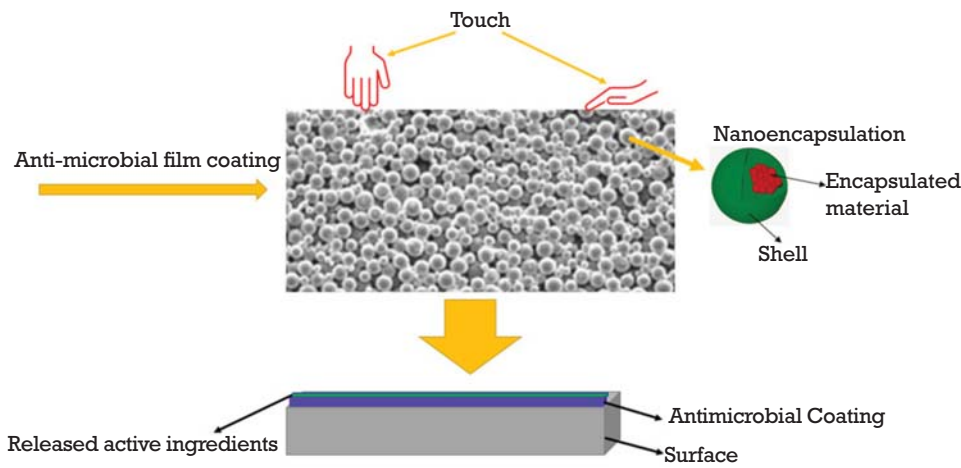
By Ellie Pritchard

Combining knowledge with practice

“I like to think of Enrico has having dual strengths,” commences Mr. Javaherdashti. “It is a knowledge-based company as well as a manufacturer. Many people think that these factors are two separate disciplines, but, in fact, we combine knowledge with practice to answer questions that so far don’t have a solution that is both

economically and ecologically viable.” His job revolves mainly around two aspects of research and development: Working on corrosion management in general, and microbiologically influenced corrosion in particular; and, supervising anti-corrosion and anti-deterioration measures for metal and non-metals by applying smart technologies based on nanotechnology methods.

It is his extensive knowledge of microbial corrosion that makes Dr. Javaherdashti such an asset to the research community. With almost three decades of academic and industry experience in corrosion management, he has identified a significant problem that occurs throughout the mechanical and chemical industries: “Corrosion is important – this is something that we who are involved in the science



Working principles of anti-microbial coating as developed and produced at Eninco Engineering B.V.: the nano-capsules will release their antimicrobial agent upon touch or ambient temperature change.

industry already know. The point is that industry experts do not know this”.

What is microbial corrosion?

Dr. Javaherdashti: “In colloquial terms, corrosion is something that happens over time without us having any control over it. It is as natural as breathing. Microbial corrosion occurs when you have the additional impact of micro-organisms (such as bacteria); it happens in systems where water is being used as a liquid”. “The impact of microbial corrosion is severe. The cost to the economy of a country can be anything between 3-6% of its GNP. For a country like the Netherlands, the annual cost of corrosion is billions of dollars. It is the same story throughout the world regardless of whether countries are developed or developing. Approximately 15-40% of all corrosion can be due to microbial corrosion”. The greatest problem that Dr. Javaherdashti recognizes is a serious lack of up-to-date research and knowledge about microbial corrosion. The industries in which it is most prevalent believe that they understand it due to it being a form of corrosion. But Dr. Javaherdashti has noticed, in the Netherlands particularly, that there are very few people in academia and research who really do grasp the problem. “I was talking to the Head of the Corrosion Department in one of the Netherlands’ leading universities a few months ago, and he told me that the last project his team had handled on microbial corrosion dated back 15 years. Can you imagine? With their knowledge being so out of date, how can you even talk about the importance of microbial corrosion?”

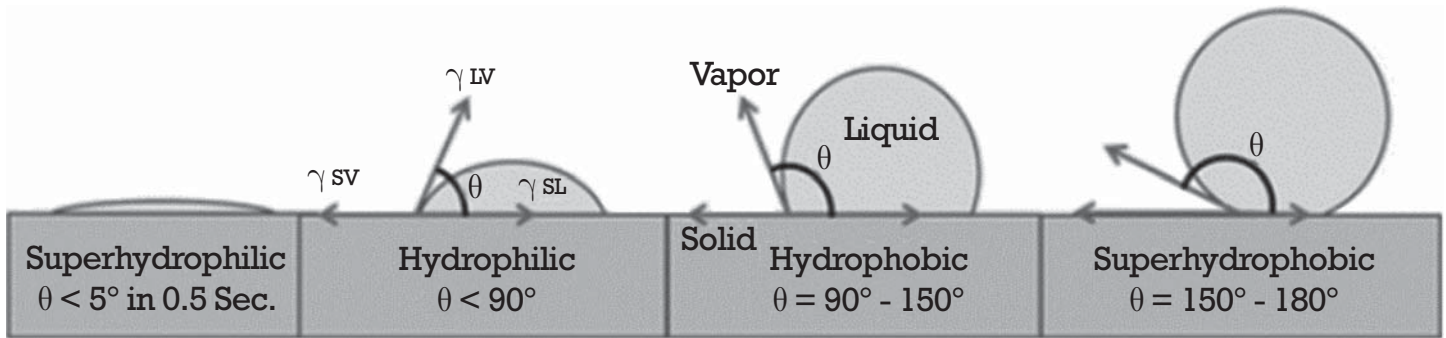
Protective tech

It is this gaping hole in the research field that Dr. Javaherdashti and his fellow Eninco colleague, Dr. Arezoo Assarian who he credits as being the coatings’ inventor and also the CEO of Eninco

Engineering B.V., are working to fill in with their development of protective smart coatings. “At Eninco we use smart, eco-friendly nano-technologies to produce paints and coatings that are resistant to microbial and other types of corrosion. Now, we are focusing on what we call ‘anti-microbial coatings’. So far, we have had incredibly good results; the new technology we apply is really working because these coatings are cost-effective, eco-friendly, and can be applied conveniently on both metallic substrates (such as steels) and non-metallic substrates (such as polymers, plastics, and glass). As a company, we also set clear goals for our anti-microbial coatings such as shorter handling and drying times, and a low level of volatile organic compounds (VOC). VOCs are organic chemicals that become a gas at room temperature and are the main origin of air pollution at ground level. We assure that our company’s new anti-microbial coatings have a high level of endurance and a



Dr. Arezoo Assarian, CEO and Head of Coating research Department, Eninco Engineering B.V.



Schematic principles of superhydrophobic coating as developed and produced at Eninco Engineering B.V.

Source: N. Nuraje, W. S. Khan, Y. Lei, M. Ceylan, R. Asmatulu, Superhydrophobic Electrospun Nanofibers, J. Mater. Chem. A, Issue 6, 2013.

very low VOC percent. We have also extended the life of the products, at the same time making them cost-effective, and most importantly eco-friendly. This is very essential because the paint industry is typically very polluting”.

Protection from other corrosions

In addition to microbial corrosion, Dr. Javaherdashti highlights the dangers of atmospheric corrosion: “It is a very vital issue especially for northern Europe. Sometimes the atmosphere itself has a very corrosive effect, particularly on all types of steel (including stainless), but also concrete, etc. It is also a considerable problem to be confronted with if you are living in a developed country due to so-called atmospheric gases (NOX/SOX) being released into the atmosphere, which can return to the ground in the form of acid rain, for example. In our work at Eninco, we are interested in finding a way to minimize the contact of the corrosive atmosphere with the susceptible material (any kind of steel, plastic-based material, wood)”.

Detective work

As a key research figure, Dr. Javaherdashti has two preferred methods when it comes to assessing failures in practice: root cause analysis and failure mode and effects analysis (FMEA). He has applied these practices for the last 20 years.

“Equipment fails, due to corrosion or any number of factors, and you go down the road of finding out what happened; what were the scenarios that collectively worked together to result in the failure? That is why we do a root-cause analysis; as the name suggests, you are trying to find the main culprit that caused that failure. For that, we refer to anything from lab data to an inspection of the failed part/equipment. The same is true with FMEA. Again, you

are trying to find the failure modes that happened to cause failure, understand the mechanisms, the causes.”

Both methods enable a team to tailor future designs and working conditions to ensure that the same failure cannot happen again. Dr. Javaherdashti refers to it as real-life detective work: “I have used root cause analysis and FMEA in more than 400 projects around the world. In all of these, you see yourself as a Hercule Poirot on the search for a culprit. You start moving in a dark night, you have no clues apart from what you get from the lab result but, combining that with your knowledge and experience, you arrive at a marketable and applicable solution”. The combination of both marketability and applicability are vital for a viable solution. Having enjoyed the challenge of trying to walk this knife-edge for 30 years, Dr. Javaherdashti is keen to highlight the necessity of both: “The solution you come up with may be applicable, but it may not be marketable because of the costs involved. I have to be honest; I really enjoy this aspect of my job; it allows me to challenge and develop myself and to see when finding a solution related to microbial corrosion, how complicated a phenomenon it can be”.

Tackling misconception with knowledge sharing

Dr. Javaherdashti also shared his concerns about common misunderstandings that occur surrounding the likelihood of occurrence and risk assessment in the industry. “Risk has a mathematical definition; it is the combination of the likelihood of an event multiplied by its consequences. The likelihood of having a corrosion issue in your plant may seem low. But if it happens, because of the major consequences that it could have, then the low likelihood and these major consequences would equal high

risk. A lot of plant managers and even experts confuse these two things. They think that if they have decreased the likelihood of corrosion in their plant then this will reduce the risk; but they forget that if it were to happen, then the consequences can be major”. Eninco deals with this concern by delivering technical consultation, webinars, and training. They alert plant managers to the fact that by reducing the likelihood of corrosion with the application of protective coatings, they also reduce the level of risk.

Stainless Steel World conference 2021

As a key member of the Steering Committee for this year’s Stainless Steel World conference, Dr. Javaherdashti shares his enthusiasm for knowledge-sharing in person. “For me, knowledge-sharing and face-to-face contact go hand in hand. It is all about interpersonal connections which can always help you to refine your options and think outside the box. I once visited a conference and went to see a speaker discussing the new technology they had developed. I overheard from the person next to me that this technology could have certain disadvantages and that it was not as good as it seemed. That led me to go and research the topic myself. “That is why I always prefer, even during this pandemic and whilst following all hygiene and protective measures, to physically go to a conference to connect with other people and have face-to-face conversations. When we sit in the comfort of our own homes watching events from afar, we miss out on opportunities to discuss different opinions. After all, we are not robots; robots perhaps can adequately share information through laptops and virtual interfaces. But we are humans, we have to sit down and talk to each other.”