

ENTREVISTA

New technological approaches for antiviral surfaces

- *The Tekniker technology centre has extensive experience in terms of manufacturing and characterising antibacterial, hygienic and biocidal surfaces that can be adapted to generate antiviral surfaces capable of providing protection to fight against the COVID-19 disease. In the interview, Borja Coto, the coordinator for Multifunctional Surfaces solution and Ruth Diez, the technology transfer manager at Tekniker, explain this issue.*

1.- Why is it important to develop surfaces that eliminate the SARS CoV-2 virus?

The current COVID-19 crisis is demonstrating the important role played by surfaces as a vector for transmission of the virus. Consequently, most protection measures are associated with hygiene and our attempts to disinfect all kinds of objects in our daily lives, including major critical infrastructures that could act as a vehicle of transmission for the virus.

We are dealing, therefore, with a very extensive field of applications as regards providing safe and hygienic surfaces to deal with viruses and bacteria, etc., for door handles, public transport handrails, construction elements and hospital materials, urban fixtures, individual and collective protection equipment, sport and hospitality facilities and critical infrastructures such as hospitals, nursing homes, stations, public transport or supermarkets, among others.

Consequently, the possibilities are endless as hygienic surfaces are required for practically everything and, given the current circumstances, materials and surfaces will play an outstanding role both now and in the near future as regards making our daily lives safer.

2.- What obstacles have you come across when developing a multifunctional surface to fight against this particular virus?

As far as antiviral surfaces are concerned, the obstacles are very clear. To date, there are practically no surface-based products that can eliminate the virus. There are also very few studies looking into how surfaces must be functionalised to provide with them anti-viral properties.

A number of studies have addressed the use of copper or silver and the extent to which they can properly deal with viruses, although there is very little scientific literature on the matter. It is not feasible, however, to use copper alloys to replace all other materials. Consequently, work must focus on existing surface materials to incorporate antiviral capabilities. We have noticed at Tekniker that there is a growing demand for antiviral surfaces from our customers and collaborators working in other sectors as they clearly offer opportunities for their products.

As regards sanitising surfaces against the virus, all the current strategies are focused on cleaning and disinfecting. Although we are dealing with a very broad field, we have extensive experience at Tekniker in terms of multifunctional surfaces and can therefore help to develop surface-hygienic products and also minimise or avoid cleaning processes altogether.

It is equally true that, thanks to our command of a wide range of technologies, our work can specifically focus on the requirements of an application and the material to be functionalised. Consequently, we are able to process all kinds of materials whether they be metallic, ceramic, polymeric, film, injected parts, textile or paper. We have obtained good results with a very broad range of materials by applying the most suitable strategy to each one of them.

As we have used these antibacterial coating strategies successfully at Tekniker, it will be simple to extrapolate them to antiviral surfaces. Likewise, it would also be possible to use other strategies applied in the past to antifouling paint or surfaces with antibacterial textures and apply them to the specificities of viruses.

3. What strategies are you using to develop hygienic surfaces?

We are using different kinds of strategies to achieve this goal.

Thanks to the solution developed for Multifunctional Surfaces, Tekniker has extensive experience with regard to several surface functionalisation technologies. Consequently, our organisation can manufacture, characterise and even transfer to the market (industrial scaling) anti-bacterial and hygienic surfaces as well as biocides as candidates to be investigated and subsequently adapted and applied to antiviral surfaces.

As mentioned before, our main strength is that we are able to apply the most suitable strategy to all kinds of target products as a function of their requirements, working conditions and material on which functionalities are to be developed.

4.- What technologies do you have at Tekniker to help develop surfaces that can eliminate SARS CoV-2?

We have an extensive range of **coating, surface texturing and additivation** technologies at Tekniker that can be applied as a function of specific needs and to also generate specific functionalities.

Firstly, we have *Physical Vapour Deposition* -PVD- technologies that use titanium and tantalum nitrides (TiN y TaN) with metallic dopants such as copper to manufacture surfaces that can destroy pathogens.

We also develop coatings based on Sol-Gel matrices and paint or lacquer with embedded metallic nanoparticles and oxides acting as anti-bacterial agents.

The advantage of this particular technology (Sol-Gel) is that, as it can be applied by spraying, it can be used on numerous products. We also resort to this technique to microencapsulate active liquid compounds in liquid form to be sprayed inside certain types of materials.

Additionally, we can also micro/nanostructure these coatings by combining active and passive antimicrobial elements on a single surface.

Thanks to these coating technologies we have also applied photocatalytic titanium oxide coatings (TiO₂) that can eliminate organic compounds by means of ultraviolet rays (UV). Likewise, we apply coatings of this kind (TiO₂) doped with ions by means of *Plasma Electrolytic Oxidation* -PEO- on titanium alloys in the case of anti-bacterial implants.

There are other surface texturing strategies that can be used individually or in combination with coatings. Consequently, and subsequent to the implementation of pulsed laser technology (direct etching of different microstructures -surface texturing -) on flat or 3D surfaces of metallic, ceramic or polymeric surfaces, we can provide materials with super hydrophobicity properties to prevent bacterial deposits and the subsequent formation of biofilm (films made up of bacterial colonies and microorganisms that proliferate and grow on surfaces).

At Tekniker, we also have extensive experience with polymers. We have developed injected parts at the technology centre with hydrophobic properties by micro-structuring the mould itself. We can also manufacture nano and microstructures as well as hierarchical structures (both nano-micro) to deliver super hydrophobicity and

antibacterial properties on film polymers by means of nano printing and *roll to roll* technologies.

5.- When will it be possible to transfer these solutions from the laboratory to the industry?

We are in touch, on the one hand, with leading microbiology centres where viruses have to be tested on surfaces. Based on our experience, we have enough capacity to perform tests with bacteria, although viruses must be tested at laboratories with high levels of biosecurity and very specific experience. Consequently, we are establishing alliances and collaborations with leading centres to develop solutions against the virus.

On the other hand, and as mentioned before, market demands are perfectly clear, even more so in the context we are currently experiencing. As a society, our vision with regard to what will have to be done in the future is clear and is based on having more protection against pandemics like the one we are currently facing provided by safer materials.

Several companies from different sectors have shown an interest in our activities related to multi-functional surfaces. It is true, however, that thanks to our *know how* in this field and to our vision of a future that will be embedded in our DNA, we are already working with other collaborating firms to implement short term solutions.

We have extensive experience in terms of scaling processes at an industrial level. This means that our track record is solid as regards assisting companies in developing and testing functionalities at laboratories level until industrial validation and implementation can take place.

To this end, we have cutting-edge capabilities and infrastructures as regards designing and manufacturing machinery and developing automation and robotics. We also have extensive experience with regard commissioning industrial facilities. This means that we have been able to assist companies throughout the entire process that has to be carried out to transform laboratory developments into real-life production processes.