From bacteria farming to functional nanocellulose materials and devices

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Cellulose is a non-toxic, degradable and almost inexhaustible bioreneweable polymer expected to play a strategic role in replacing petroleum-based polymers and advancing towards a more circular economy. Nanocelluloses combine the properties of cellulose with the high surface area of nanomaterials. Increasing demand for cost-effective sustainable and high-performance materials makes nanocelluloses attractive for innovative applications in many sectors encompassing photonics, food packaging, flexible electronics or biomaterials. In particular, bacterial nanocellulose (BC) produced by microbial fermentation with the same molecular formula as plant-derived cellulose but with higher degree of polymerization, purity and crystallinity has captured the interest of material scientists.

In our group and in collaboration with several labs in Europe, we exploit BC exceptional features to create advanced functional materials. First, I will describe some strategies to control BC topography and microstructuration during its biosynthesis [1]. I will then show an original route to attain a multi-nanoparticle millefeuille for a BC-layered construct (Figure 1) [2]. Finally, I will present some BC potential applications in energy (thermoelectrics [3] and photovoltaics [4]) and in health [5] (corneal bandage [6] and as cell culture supports [7])

References

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Figures

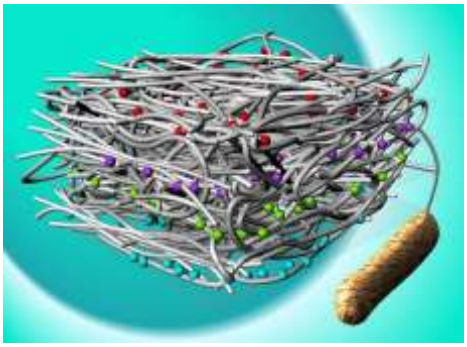

Figure 1. Bacterial cellulose films with multiple functional nanoparticles in confined spatial distribution