Bacterial cellulose, a natural polymer for biological applications

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Looking towards green resources to fabricate advanced functional materials, cellulose seems to be a good candidate as it constitutes the most abundant renewable biosphere-produced polymer. Specially, nanocellulose is in the spotlight when designing new functional (bio)nanocomposites due to its characteristics: hydrophilicity, biodegradability, high porosity, transparency, high water holding capacity, chemical tunability and formation of semi-crystalline morphologies.

Cellullose can be synthesized by bacteria or obtained from plants, algae and fungi. In particular, bacterial cellulose (BC) does not contain lignin and hemicelluloses, potentials sources of toxicity present in plant cellulose. It also exhibits a higher degree of polymerization (DP 2000-8000) and better crystallinity (60%-90%). It presents a high elastic modulus (79GPa measured in a single fiber by AFM) and high tensile strength (200-300MPa). The highly porous matrix created by the nano-fiber gives to the material its large water holding capacity. Moreover, it offers the possibility to impact on its micro(nano)structuration and shape during its production.

Due to its properties, BC has an enormous potential in sectors as energy, health and catalysis therefore its investigations have been steadily increasing.

In this presentation will introduce how we can obtain novel bacterial cellulose nanocomposites with different types of nanoparticles for biomedical applications. The possibility to control the formation of the BC (in situ) and the modification after BC synthesis, ex situ, will be illustrated.

These innovative bacterial cellulose structures will provide the proof of concept for devices or products.

References

[1] Zeng et al. Journal of Materials Chemistry C (2014) ,2 ,6312-6318, DOI: 10.1039/c4tc00787e.

[2] Zeng et al. Cellulose (2014), 21, 4455–4469, DOI 10.1007/s10570-014-0408-y.

Figures

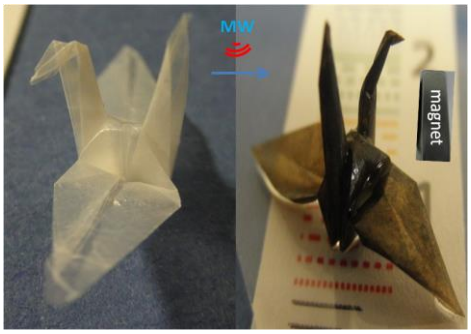

Figure 1. BC origami at the left which we composed with iron oxide nanoparticles to make it responsive to a magnetic field.

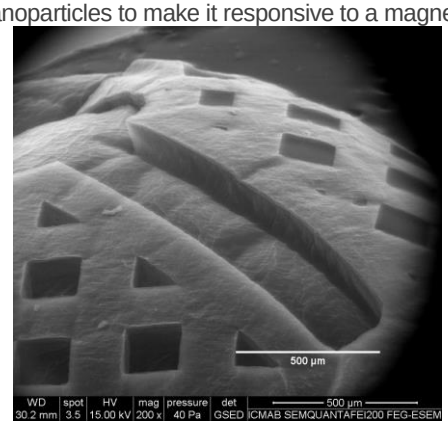

Figure 2. Topographic control of BC films in situ using microfluidic stamps.