Cellulose responsive composites: control at the nanoscale

Anna Laromaine Sagué
Soledad Roig, Irene Antón-Sales, Anna Roig

Institut Ciencia de Materials de Barcelona, Campus UAB, 08193 Bellaterra, Spain.)

alaromaine@icmab.es

The need to provide eco-friendly materials to reduce costs and risks associated to waste echoes in many fields In this context, raw materials of natural origin and in particular natural biopolymers like cellulose play an important role. Cellulose and nanocellulose-based materials have emerged as interesting candidates to industries, governments and consumers as green, sustainable and natural materials for the fabrication of advanced complex composites.

Additionally nanoparticles (NPs) offer the possibility to chemically and structurally tune their properties influencing how they interact with different materials.

The possibility to combine materials of raw origin, like cellulose, with nanoparticles open new avenues in the development of novel materials, which harness nanotechnology and nature.

In this context, we will present our latest development on novel stimuli responsive materials for a variety of applications based on bacterial cellulose, we will show a strategy to create multifunctional bacterial cellulose laminate material with topographic confinement of several types of nanoparticles using microwave-assisted synthesis routes and taking advantage of the self-adhesion of the BC fibers upon drying. This approach allowed us to create new functional materials on demand.

References

[1] Zeng, M.; Laromaine, A.; Roig, A. Bacterial Cellulose Films: Influence of Bacterial Strain and Drying Route on Film Properties. *Cellulose* **2014**, *21* (6), 4455–4469.

[2] Abol-Fotouh, D.; Dörling, B.; Zapata-Arteaga, O.; Rodríguez-Martínez, X.; Gómez, A.; Reparaz, J. S.; Laromaine, A.; Roig, A.; Campoy-Quiles, M. Farming Thermoelectric Paper. *Energy Environ. Sci.* **2019**, *12* (2), 716–726.

[3] Anton-Sales, I.; Beekmann, U.; Laromaine, A.; Roig, A.; Kralisch, D. Opportunities of Bacterial Cellulose to Treat Epithelial Tissues. *Curr. Drug Targets* **2018**, *20* (8), 808–822.

[4] Zeng, M.; Laromaine, A.; Feng, W.; Levkin, P. A.; Roig, A. Origami Magnetic Cellulose: Controlled Magnetic Fraction and Patterning of Flexible Bacterial Cellulose. *J. Mater. Chem. C* **2014**, *2*, 6312–6318.

[5] Roig-Sanchez, S.; Jungstedt, E.; Anton-Sales, I.; Malaspina, D. C.; Faraudo, J.; Berglund, L. A.; Laromaine, A.; Roig, A. Nanocellulose Films with Multiple Functional Nanoparticles in Confined Spatial Distribution. *Nanoscale Horizons* **2019**, *4*, 634–341.

Figures

Figure 1: Bacterial cellulose films and its responsive nanocomposites.