CYCLE DE CONFÉRENCES DE CHIMIE

Avec le concours de : Université Clermont Auvergne
INP Clermont Auvergne

Mardi 4 juillet à 14 h

Amphi Rémi (site des Cézeaux)

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Controlled structuration of electrospun nanofibrous materials at different length scales: from the elaboration to the applications

Electrospinning is well-known to produce non-woven mats thanks to the random deposition of a polymer nanofiber under the action of a high electric field. However, it is shown that the fabrication of micro-structured mats is also possible when the nanofiber is deposited on a patterned collector made of regularly distributed protuberances. The fabrication of such nanofibrous structured mats results from the building of an electrostatic template leading to the formation of a local field of attractive and repulsive forces driving the deposition of the nanofiber during its landing.

Our team developed this so-called "electrostatic template assisted deposition" (ETAD) and investigated the involved physical mechanisms through experiments and modeling in order to achieve the best fine-tuning of the nanofibrous micro-structures [1-4]. Moreover, ETAD was used for the fabrication of nanofibrous micro-structured composites by the alternate deposition of electrospun nanofibers and electrosprayed microparticles onto a patterned substrate. Numerical simulations of this process were conducted[4] and gave more insight into the mechanism of deposition.

Finally, depending on the nature of the nanofibers and the microparticles, such advanced 2D and 3D micro-structured nanofibrous materials can find applications in different fields such as biochips[1], biomimetic scaffolds[5,6] as well as multi-layered wound dressing embedding iron-based layered double hydroxide for drug storage and controlled release[7]. Finally, it will be shown that hierarchical structured carbon-based composites with controlled shape and characteristic sizes ranging from nm to mm length scales can also be elaborated by 3D electrospinning/electrospraying followed by pyrolysis and chemical vapor deposition. Such carbon hierarchical fibrous composites were applied as a metal-free catalyst for the steam- and oxygen-free catalytic dehydrogenation of ethylbenzene to styrene[8].

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[2] M. Liang et al., *Polymer*, vol. 200, 122576, 2020.
[3] M. Liang et al., *Advanced Materials Interfaces*, vol. 8, n°202101302, 2021.
[4] C.R. Wittmer et al., *Polymer*, vol. 55, pp. 5781-5787, 2014.
[5] A. Garcia Garcia et al. *ACS Biomater. Sci. Eng.*, vol. 4, pp. 3317–3326, 2018.
[6] L. Terranova et al., *ACS Biomater. Sci. Eng.*, vol. 7, pp. 5775−5787, 2021.
[7] M. Pires Figueiredo et al., *European Polymer Journal*, vol. 131, 109675, 2020.
[8] Y. Liu et al., *Journal of Materials Chemistry A*, vol. 5, pp. 2151-2162, 2017.

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