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Nanocomposites with controlled interfaces as biomaterials with enhanced performances



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Nanocomposite biomaterials are largely developed in biomedical applications as imaging agents, as sensors, as smart drug delivery systems, etc... However, while the inorganic nanoparticles (INPs) are classically embedded in the polymer matrix or coated with polymer, the direct and uniform anchoring of INPs at the surface of polymer nanoobjects is still a major challenge. This is especially true for electrospun polymer scaffolds where the incorporation of INPs results not only in beaded defects and a larger distribution in the diameter of the fibers, but also strongly impacts their mechanical and degradation properties, as well as the intrinsic properties of the INPs (eg. magnetism). In this contribution, to overcome these limitations, we will present an efficient strategy for the direct and uniform anchoring of INPs on functionalized-poly(lactide) (PLA) nanofibers surface *via* a simple free ligand exchange procedure. We will illustrate this strategy through two types of INPs: superparamagnetic iron oxide nanoparticles (SPIONs) to yield magneto-scaffolds and lanthanide-doped hydroxyapatite nanoparticles (L-HA) to yield hybrid scaffolds with dual-modality imaging properties. For both type of biomaterials, full characterization will be provided with an emphasis on the morphology of the nanocomposites that present a well-defined quasi-monolayer of INPs with a complete and homogeneous coverage of the surface of PLA nanofibers by the INPs Fig.1 [1]. The resulting higher outcome in terms of imaging and magnetic properties will be discussed in the frame of tissue engineering applications to demonstrate the high potential of these nanocomposites with well-defined interfaces.

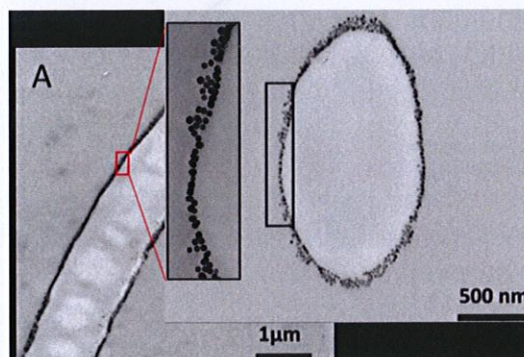


Figure 1: TEM imaging of well-defined core-shell PLA@SPIONs nanocomposites.

[1] Awada H. *ACS Appl. Mater. Interfaces*. (2019)