SYNTHETIC POLYPEPTIDE POLYMERS AS SIMPLIFIED ANALOGUES OF CONJUGATED PROTEINS

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The challenge of creating synthetic materials with the structural sophistication and complex functions found in biology has long been a goal in materials science.[1,2] For instance, the use of natural proteins as building blocks for materials design holds tremendous promises in many applications, but their large-scale industrial production still remains difficult.[3,4] The design of synthetic analogues by using chemistry is an alternative approach to genetic engineering in a context were synthetic peptide-based materials could partially reproduce structural or functional features of their natural models.[5,6] In chemistry, the most economical and efficient process to prepare synthetic peptide chains is a one-step polymerization process, the ring-opening polymerization (ROP) of *N*-carboxyanhydride monomers.[7] This controlled polymerization process 1) allows the preparation of polymers made of amino acids in both, good yields and large quantities and 2) is an ideal way to create protein mimics structures for materials science applications (as its easy scale up becomes simple).[8] In chemistry, synthetic macromolecules have long been used to reproduce natural protein properties.[9] For instance, polypeptides polymers can reproduce their natural secondary structures including α-helices or β-sheets and this property is highly sought after in polymer science.[10] Compared to synthetic polymers presenting a coil structure, structured polypeptides exhibit intriguing physicochemical properties in bulk, at the surface and/or in solution.[11] An important point of this structuring ability is that polypeptide polymers can undergo secondary structure transitions that can be easily implemented and tuned by tailoring amino acid side chains.[12] In this context, the talk will illustrate how coordination chemistry or DNA binding can be used to prepare smart polymeric systems whose structuring switch would be interesting to prepare advanced materials (figure 1).[13]

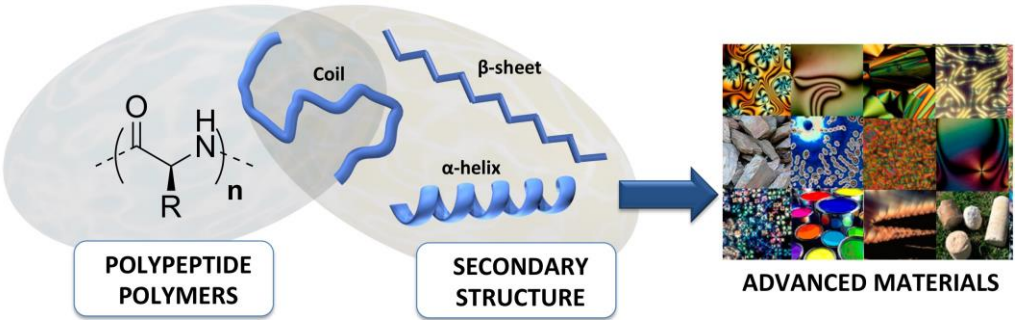

Figure 1. Synthetic peptide-based polymers represent a unique class of macromolecules able to mimic the properties of natural proteins in materials sciences since they can fold into different secondary structures in the same way as do proteins.

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