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Approach Towards Auxetic Materials and Synthesis of Bio-Inspired Responsive Polymers

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Nature has evolved in a different type of high-performance polymeric material. These materials show excellent properties from the macroscale to the nanoscale. Nature's vivid structural colours are a long-standing subject in the scientific community. These explicit natural structures consist of coloured photonic pigments. Understanding the functions and colours of natural materials can inspire us to produce multifunctional nanomaterials and nanodevices. Bio-inspired structures have been highly pursued in the fabrication of synthetic polymeric materials due to their potential to break the bottlenecks in mechanical properties and extend the application of polymeric materials. Here, bio-inspired polymers have been synthesised for different applications and studies.

The synthesis of the microcapsules using the interfacial polymerisation method has been described for designing the bio-inspired mechanoresponsive material. These microcapsules were embedded into the amine-functionalized polymeric matrix. Mechanoresponsive properties of the microcapsules embedded composites have been analysed by a dynamical mechanical analysis (DMA) instrument. The next project describes the synthesis of a series of homo and triblock bottlebrush terpolymers. These ABC bottlebrush terpolymers have been shown different colours after solvent cast or annealing. The self-assembly of the bottlebrush terpolymer (after annealing) is investigated by UV-visible reflection spectrophotometer, scanning electron microscopy (SEM) and SAXS.

A bio-inspired artificial spider silk-type poly (butyl acrylate-b-terephthalamide) block copolymer has been reported in another project. The synthesis of block copolymers was reported using the two most versatile living polymerisation methods (SET-LRP and living aromatic polymerisation methods). The poly butyl acrylate-*b*-terephthalamide block copolymers have been synthesised by deprotection of the DMB-protecting group. The self-assembly of protected and deprotected block copolymers has been investigated by scanning electron microscopy (SEM), showing rectangular rod-type structures (after deprotection). In the last bio-inspired project, the synthesis of amphiphilic rigid aromatic amide oligomer has been described. The amphiphilic rigid oligomers are designed to study antimicrobial properties.

Jury:
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