ABSTRACT

Title: Precision-built polymer nanostructures and their use in biomedical applications.

Current methods to build polymer nanostructures in water rely on the self-assembly of block copolymers. This process is usually time consuming, is not scalable and often leads to a broad distribution of sizes and the presence of high amounts of kinetically trapped structures. Emulsion polymerization is a synthetic method to make polymer nanostructures directly in water and at scale but has limited capability to produce other structures than spheres. My group has developed a new method (i.e. the TDMT method) that utilizes the advantages of emulsion polymerization and self-assembly to produce a wide range of nanostructures, ranging from worms, toroids and the asymmetric tadpole structures. Because of the self-assembly process, we can functionalize the surface of these nanostructures with a judicious choice of chemical functionality, making these functional nanostructures useful in a wide range of applications. In this seminar, I will show how to synthesize these nanostructures and how they can be used to kill viruses (especially all variants of SARS-CoV-2, including the most virulent Delta), enrich embryonic stem cells, self-adjuvating vaccines, target triple negative breast cancer and for the delivery of siRNA to cancer cells. Finally, I will show some exciting work on the synthesis of precision-built and monodisperse spheres by a self-interrupted living polymerization.