

Title: Applied Soft Matter Physics: From Industrial Formulations to Soft Confined Polymers

Abstract: In this talk, I will present our modelling work on two applied problems in soft matter physics.

First, I will discuss small-molecule migration in multicomponent mixtures. When mixtures containing both high and low molecular weight components are exposed to air, the smaller molecules tend to migrate to the surface. This phenomenon is common in industrial formulations, where the active ingredient is often a small molecule, and surface migration can lead to a significant loss of performance. I will describe a modelling framework that allows us to quantify and ultimately control this process.

Second, I will highlight our recent theoretical work on polymer conformations in soft tubular confinement. Unlike rigid tubes, where chain organization is dictated by the tube diameter and axial packing, soft tubes can deform in response to the polymer. Here, equilibrium emerges from a balance between the mechanical pressure exerted by the chain and the elasticity of the tube itself. This interplay leads to new conformational behavior that we are beginning to map systematically.