



International Conference on Micro Nano Fluidics (ICOM 2025)



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Tentative topic of the invited talk

Advanced Microfluidic Platforms for Viscoelastic Instabilities and Biosensing Applications

Abstract of the invited talk

Microfluidics offers unique control over small-scale fluid dynamics, enabling exploration of complex viscoelastic phenomena while advancing precision diagnostics. This talk highlights recent progress in microfluidic platform development, combining robust glass microfabrication via selective laser-induced etching (SLE) with integrated optical and chemical sensing techniques. We present experimental and computational insights into viscoelastic instabilities—such as synchronized oscillations, elastic turbulence, and metachronal waves—emerging in structured microenvironments including cross-slots, porous networks, and micropost arrays. Concurrently, we demonstrate how these platforms enhance biosensing performance through improved analyte transport, signal amplification, and flow-induced surface interactions. Case studies in cortisol detection and cytokine sensing illustrate how flow conditions can be tuned to optimize biomolecular recognition. Together, these studies underscore the dual utility of microfluidic systems as tools for probing nonlinear fluid mechanics and as enablers of high-sensitivity, real-time biosensing for personalized healthcare and lab-on-chip technologies.