Extra session of Focus Materialchemie – Monday, **24.6.2024** 15:00 – @ BA 01 56A (CAD Arbeitsplätze) (TU-Wien, Getreidemarkt 9, BA) – join us on ZOOM (ID: 983 0066 2349)

Multifunctional nanopores and 2D material surfaces for single-molecule studies

Sabina Caneva

S.Caneva@tudelft.nl

Department of Precision and Microsystems Engineering, Delft University of Technology, The Netherlands

---

Single-molecule techniques are emerging as powerful tools to investigate the dynamics, mechanics and interactions of biomolecules with high spatial and high temporal resolution. They are increasingly used to answer fundamental questions in biology and are employed in next-generation sequencing for molecular diagnostics. In this talk, I will present two platforms for single-molecule studies. The first will focus on 2D material optofluidics, where we leverage the atomically-smooth and fluorescence compatible surfaces of hexagonal boron nitride crystals to study DNA binding and diffusion. We find that the diffusion behaviour is dependent on a number of parameters including DNA length, hBN surface topography and defect content.

In the second part, I will introduce DNA origami nanoactuators as size-selective nanopores enabling on-demand molecular transport across lipid bilayer membranes. We leverage the structural precision of DNA origami nanotechnology with machine-inspired component design to generate structurally-adaptable nanopores featuring reversible gating triggers. Using AFM, TEM and DNA PAINT we confirm the conformational changes that modulate the size of the nanopore channel. Additionally, we demonstrate localization of the actuators at the membrane via confocal fluorescence imaging, and illustrate size-selective translocation of dextran molecules of different molecular weights via dye influx assays. These fully-reconfigurable structures can be employed in the delivery of macromolecules, as well as in the development of synthetic cells.

Short bio:

Sabina Caneva is a tenure track Assistant Professor at TU Delft. She obtained a BSc and MSc in Materials Science from Oxford University (2012) and PhD in Engineering from the University of Cambridge (2016). Subsequently, she joined the Kavli Institute of Nanoscience in Delft as a Marie Curie postdoctoral Fellow focusing on molecular electronics with 2D materials. In 2020, she was awarded a Delft Technology Fellowship to start her independent research group at the Department of Precision and Microsystems Engineering. Her group develops nanoelectromechanical systems for single-molecule biophysics studies using a combination of 2D material nanodevices, optical nanoscopy and acoustofluidics.