UCLA Engineering
HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE

BIOENGINEERING

PRESENTS

Pores with Undulating Diameter for Multipronged Characterization of Single Particles and Cells in the Resistive-Pulse Technique

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2101 ENGINEERING V

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ABSTRACT:

Single pores in resistive-pulse technique have been successfully used for the detection of cells, viruses, particles, and even molecules such as DNA and proteins. We have investigated application of pores with undulating opening diameter for the detection of particles and characterization of their physical and mechanical properties including size, shape, and squishiness. The resistive pulses generated by polymer spheres passing through these pores had a repeatable pattern of large variations corresponding to these diameter changes. We showed that this pattern of variations enabled the unambiguous resolution of multiple particles in the pore, that it could detect transient sticking of particles within the pore, and that it could confirm whether any individual particle completely translocated the pore. These results have practical importance for increasing the speed of resistive-pulse sensing, optimizing the detection of specific analytes, and identifying particle shapes. We also showed that pores with undulating opening diameter developed local pressure drops, which were sufficiently large to probe mechanical properties of passing objects. Application to hydrogels as well as biological cells will be discussed. I will also present our newest direction of research in which we are using 'rough' pores with undulating diameter to understand fluid flow at nano and microscale, and identify conditions for broken time symmetry of mass transport through such pores.

BIOGRAPHY:

Dr. Zuzanna Siwy was born in Poland where she earned her PhD from the Silesian Technical University in Gliwice. In 2000-2003 she was named Fellow of the Foundation of Polish Science and the Alexander von Humboldt Foundation at the Institute for Heavy Ions Research in Darmstadt, Germany. She joined faculty of the University of California, Irvine in 2005. Her research focuses on understanding ionic and molecular transport at nano and microscales for building biosensors, ionic circuits, and biomimetic systems. In 2006 she was named a Fellow of the Alfred P. Sloan Foundation, and in 2010 she received the Presidential Early Career Award for Scientists and Engineers. In 2014 she was elected a Fellow of the American Physical Society.