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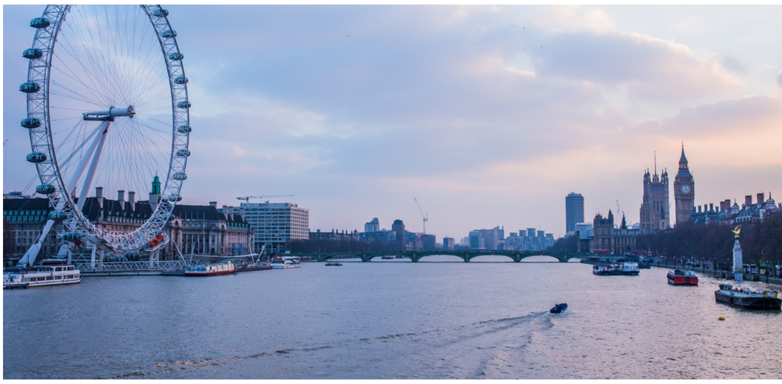
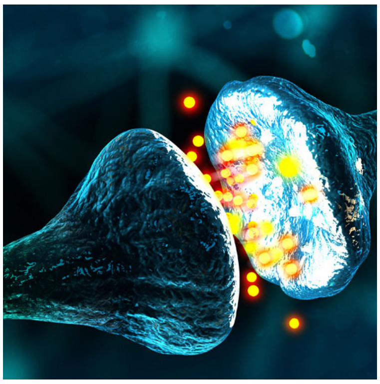
Nanomaterials 2018

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Anatoliy V Glushchenko

University of Colorado, USA

Liquid crystal polymer composites doped with ferroelectric nanoparticles – novel optical materials for tunable lenses, prisms and beam steering devices

This presentation addresses the critical need of a modern optical industry for low driving voltage adaptive materials providing large phase retardation (for UV, visible and IR) within a sub-millisecond time frame. Two technologically innovative research areas are pursued in parallel and then merged, resulting in the creation of a new class of optical materials - ferroelectric nanoparticles doped liquid crystal / polymer composites. The first research direction advances the development of a liquid crystal being immersed into a nano-structured sponge-like polymer network. The network's long chains impose a desired alignment for liquid crystal molecules enabling the creation of thick homogeneous liquid crystal slabs (up to 1 mm, in comparison with available today only 50 microns thick aligned liquid crystal layers). On the other hand, mixing ferroelectric nanoparticles with a liquid crystal, generates ultrahigh electric fields within the liquid crystal, which, combined with their small size, produces a uniquely exciting and largely unexplored system of composite materials which exhibit novel collective particle-host interactions. These interactions promise a variety of exotic electro-optic and other applications. In this case, ferroelectric nanoparticles share their high intrinsic sensitivity to electric fields with the entire liquid crystal matrix. Therefore, doping the liquid crystal with ferroelectric nanoparticles, progressed as the second research direction simultaneously with the first one, brings benefits of a lower driving voltage and faster switching speed than in any liquid crystal devices available today. As a result, we demonstrate the power of nanotechnology to amplify by orders of magnitude the natural properties of liquid crystals by doping them with nanoparticles and hosting them in a Nano-confining polymer matrix.

Speaker Biography

Anatoliy V Glushchenko received his Ph.D. in Physics in 1997 from the Institute of Physics, National Academy of Science (Kyiv, Ukraine). He is a professor of Physics at the University of Colorado at Colorado Springs (UCCS) where he teaches advanced Physics classes, directs the Center for Advanced Technologies & Optical Materials and leads the broad range of fundamental and applied research in biophysics and soft condensed matter. He is the author of more than 200 research papers and patents and made more than 250 presentations at various conferences.

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Noritada Kaji

Kyushu University, Japan

Micro and nano-sensing techniques for the diagnosis of bacteria and cells

A microfluidic device based on ionic current sensing system for high-throughput and practical single bacteria and mammalian cell sizing was developed and furthermore, discrimination of bacterial species and mammalian cell deformability was achieved. The highly precise sizing system based on blocking ionic current at narrow microchannel provided the information on antibiotic resistant strains of bacteria. Deformability changes associated with passage of adipose tissue-derived stem cells (ASCs) were also successfully detected by the device without any chemical or biological modification. The mechanical properties of a cell are extremely important because changes in the mechanical properties are indicative of diseases ranging from diabetes to malignant transformation. Considering the heterogeneity within a population of cancer cells and stem cells, a robust measurement system at the single cell level is required in both research and clinical situations. Recent developments in microfluidic devices have advanced the throughput of mechanophenotyping measurements. However, since most of these assay techniques essentially rely on optical detection systems, the spatial resolution was limited to a few µm in the xy plane and less in the z direction. We have proposed the microfluidic device with two consecutive constrictions for a single cell sizing and deformability measurements based on blocking ion current. In this work, we validated the methodology and expanded the application field to stem cell research.

Speaker Biography

Noritada Kaji is a professor of the Graduate School of Engineering at Kyushu University, Japan. He obtained a bachelor's degree in Pharmaceutical Sciences in 2000 and PhD degree in 2004 from the University of Tokushima, Japan. In his PhD study, he developed nanopillar chips that were a state-of-the-art µTAS combined with nano-fabricated structures for DNA analysis. After his postdoctoral research, he started working as an assistant professor of the Department of Applied Chemistry at Nagoya University from February 2005 and promoted as an associate professor from November 2011. He became a full professor of Department of Applied Chemistry at Kyushu University from January 2018. His current research interests are mainly divided into the following parts; Development of micro and nanofluidic for single molecule biophysics and molecular biology, integration of whole biological processes on a single chip for systems biology.

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