Title: Spectroscopy and Microscopy Measurements of Nanomaterials at Single Entity Level.

Abstract:

Nowadays, our society faces, and will likely continue to confront, an array of formidable challenges, from the crisis of energy shortages to the relentless battle against cancer. Addressing these critical issues necessitates the development of advanced materials for efficient energy conversion and storage and requires advancements in drug development and more effective treatment procedures for cancer. To overcome these challenges, a thorough comprehension of the problems from all perspectives is essential, with a particular emphasis on the fundamental understanding of the physical phenomena governing chemical and biological processes in these issues. This knowledge forms the cornerstone of our ability to tackle these complex issues successfully. Acquiring and advancing this fundamental understanding is crucial, serving as the linchpin in the chain of solutions.

Optical microscopy imaging of single molecules and particles has emerged as a crucial tool in studying fundamental chemical and biological processes at the molecular and nano scales. By elucidating static and dynamic heterogeneities among seemingly identical molecules, it transcends the limitations of traditional ensemble experiments and inspires new discoveries. In my research lab, our overarching aim is to pioneer new frontiers in chemical and biological exploration through the development and utilization of innovative optical imaging platforms. These cutting-edge methods offer nanometer-scale spatial resolution, microsecond to millisecond temporal resolution, exceptional sensitivity, and the ability to detect single entities, all while providing rich chemical information. Leveraging these optical techniques, we delve into vital chemical and biological processes such as endocytosis, cell mechanics, cancer migration, heterogeneous catalysis in solid catalysts, and structural and morphological changes in nanomaterials. We anticipate that the outcomes of our research will profoundly influence the design of disease treatments, catalysts, and functional materials.

In this seminar, I will share with you some of our works on chemical measurement of heterogeneous catalysis in 2D layered materials at single molecule level, and our works on the development of high throughput single molecule single particle hyperspectral microscopy.

Biosketch:

Bin Dong is an assistant professor of Chemistry and Biochemistry at University of Arkansas, Fayetteville. Bin received his B.S. from Xiamen University in 2007, did Ph.D. work with Prof. Ning Fang at Iowa State University from 2011 to 2015, and continued his postdoctoral research with Prof. Ning Fang at Georgia State University. Bin joined the University of Arkansas, Fayetteville in Fall 2021. His research develops newly advanced optical microscopy imaging and spectroscopy

systems, and investigates dynamics processes in functional materials and biophysics under in-situ conditions. Current studies include single molecule imaging, super-resolution imaging, single particle tracking, advanced optical microscopy, and spectroscopy systems development. Bin's work is currently funded by the American Chemical Society Petroleum Research Fund (ACS PRF), Doctoral New Investigator grant and Society for Analytical Chemists of Pittsburgh (SACP) Starter grant.