TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr. College *of* Engineering™

Department of Electrical and Computer Engineering Seminar

Engineering Nanoparticles for Biosensing

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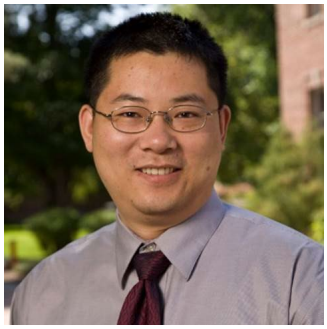
Time: Monday 1/31/2022, 3:00~4:00 PM
Location: ECE 221
Zoom Meeting:
https://texastech.zoom.us/j/93052765067?pwd=M2MzZjZ6eE4rMi9nY3JWZkJwN2piQT09
Meeting ID: 930 5276 5067 **Passcode:** 156428



Speaker Biography:

Dr. Xiaoshan Zhu received his Ph.D. degree in Electrical Engineering from the University of Cincinnati in 2005, and worked as a research scientist on sensor/instrument development in Yellow Springs Instrument, OH in 2005 ~ 2008. Currently, he is an associate professor in the Department of Electrical and Biomedical Engineering at the University of Nevada Reno (UNR). He was the interim director of Biomedical Engineering Program at UNR in 2010 ~ 2015. He received the IEEE Medal for Most Available Professor of the Nevada Chapter in 2019. He is a recipient of NIH Academic Research Enhancement Award (2020). His research interests include nanomaterials with new chemical/physical properties for biosensing/imaging, sensory systems integrating nanomaterials and MEMS technologies for health-care and/or environmental monitoring, and instrumentation for highly sensitive and accurate sensing measurements.

Abstract:

Time-gated fluorescence measurement (TGFM) utilizing long-lived fluorescence probes is an important biosensing technology. In TGFM, following pulsed excitation, sample autofluorescence fades out within tens of nanoseconds, however the probes can continue emitting fluorescence up to milli-seconds. Thus TGFM can achieve a high signal/background ratio. Although many probes for TGFM such as luminescent-metal-complex probes and lanthanide-doped nanoparticles are in development, they generally need sophisticated/expensive instruments for biosensing applications due to their limited optical properties. In TGFM, bright probes possessing both low-energy (visible light) excitation and long lifetimes up to milli-seconds luminescent are highly desired, because such optical features can significantly simplify optical and electronic design in time-gated instruments (e.g., adopting non-UV grade optics or low-speed electronics),

lower the instrument complexity and cost, and facilitate broader applications of TGFM including point-of-care or in-field testing. In our work, in order to overcome the shortcomings of many current probes, we developed Mn doped I(II)-III-VI nanocrystals (NCs) to achieve all desired optical features through investigating how the optical properties (fluorescence/absorption spectra, brightness, and lifetimes) of the Mn doped NCs are affected by different host NCs, Mn concentrations in host NCs, and ZnS shelling approaches. With optimal synthetic conditions, a library of Mn doped NCs with the desired optical features were achieved. Additionally, we developed a compact/portable TGFM instrument with high sensitivity and cost-effectiveness for these NC-based probes as signal reporters. We applied the NC probes and the instrument for the sensitive detection of the biomarker of infectious pathogen Burkholderia pseudomallei in human serum. Our new technology should have potential to not only convert many non-time-gated fluorescence assays to time-gated assays for higher sensitivities, but also facilitate the development of highly sensitive assays for in-field rapid diagnosis. This presentation will summarize our recent progress on the topics of nanoparticles for TGFM-based biosensing, and also will discuss some research perspectives.