ABSTRACT:
The fast developing technology of electrospinning is a unique and straightforward method to produce polymer, ceramic, and carbon/graphite fibers with diameters down to the nanometer range (ca. 10-1000 nm). Electrospun nanofibers possess many extraordinary properties including small diameter and the related large specific surface area, and ordered molecular/crystalline orientation and the resulting superior mechanical properties. In electrospinning, electric force alone is utilized to drive the spinning process and to produce nanofibers. Polymer nanofibers are electrospun directly from polymer solutions or melts. Ceramic nanofibers are made by electrospinning the solutions containing precursors of ceramics and carrying polymers followed by high temperature pyrolysis. Carbon/graphite nanofibers are made through stabilization and carbonization/graphitization of polymer nanofiber precursors. Unlike nanorods, nanotubes and nanowires, which are discontinuous, produced mostly by synthetic bottom-up methods, and usually require further expensive purifications, electrospun nanofibers are continuous and produced through a top-down nanomanufacturing process, which results in low-cost continuous electrospun nanofibers that are also relatively easy to align, assemble and process into applications. Additionally, electrospun nanofibers can be prepared with different morphologies (e.g. cylinder-shaped, beaded, wrinkled, foamed, and ribbon-shaped); various nanofillers (e.g. layered silicates and carbon nanotubes) can be readily incorporated into electrospun nanofibers with the filler particles closely aligned with the nanofiber axes. Furthermore, electrospun nanofibers can also serve as the templates for the preparation of numerous nanotubes; and the mat/felt made of electrospun nanofibers offers unique capabilities to control the porosity. Therefore, electrospun nanofibers have been of significant scientific, military and commercial interests including, but not limited to, composites, filtration, catalysis, biomedical applications (e.g. tissue engineering and drug delivery), electronic applications (e.g. capacitors, transistors and diodes), and aeronautics and space applications (e.g. extremely high-performance composite structures). This talk will focus on discussing about the current technology challenges/bottlenecks of “Electrospinning and Nanofibers” and their potential solutions. Additionally, the structure/property relationships of polymer, ceramic and carbon/graphite nanofibers, and the post-electrospinning processes (e.g. stretching, crosslinking, and under-tension stabilization and carbonization/graphitization) will also be discussed.

BIOGRAPHY:
Dr. Hao Fong is currently an assistant professor in chemistry and chemical engineering at South Dakota School of Mines and Technology. Dr. Fong earned my Ph.D. in Polymer Science at the University of Akron in 1999. Upon graduation, he then served as an on-site contractor in the Wright-Patterson Air Force Base in 2000&2001. After that, Dr. Fong became a staff research scientist at NIST. In 2003, Dr. Fong joined the South Dakota School of Mines and Technology (SDSM&T) as a tenure-track assistant professor. In the recent five years at SDSM&T, besides teaching undergraduate/graduate classes including “General Chemistry”, “Organic and Biochemistry” and its associated lab, “Fundamentals of Organic Chemistry”, “Polymer Chemistry”, “Chemistry of Materials”, and “Nanotechnology”, Dr Fong have been working diligently to establish a vigorous research program on “Nano-scaled Polymer, Ceramic, Carbon/Graphite Fibers and Their Applications”. His research has been supported by the NSF-EPSCoR, NIH/NIDCR, Army, Air Force, NASA, and the State of South Dakota with the total funding amount over $2,000,000. His research has resulted ~15 peer-reviewed articles, 3 book chapters, 1 patent, and numerous symposium proceedings/presentations. Three students have earned their M.S. degree in Materials Science and Engineering under is supervision. Currently, his research group has 1 postdoctoral research scientist, 2 visiting professors, 2 Ph.D. students, 3 M.S. students and 1 undergraduate student. Additionally, Dr. Fong also organized a symposium at the American Chemical Society National Meeting, edited a book, served as a reviewer for numerous scientific journals and funding agencies, and served as a member in several high profile committees/councils at the SDSM&T and/or in the State of South Dakota.