

## Ultrafine Polymer Fibers: Process, Properties and Application

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Abstract: Ultrafine polymer fibers, with diameters less than one micron, constitute a diverse and exciting class of “1-D nanomaterials”, with a growing range of applications. These fibers can be produced from a wide range of organic materials and inorganic precursors, and typically have high specific surface areas, as a result of their nanometer-scale fiber diameters. They offer several potential benefits compared to conventional microfibers, most notably in applications such as composites, filters, tissue engineering and nanotechnology. Electrospinning technology provides a remarkably simple and inexpensive means to fabricate these materials for applications that take advantage of their unique qualities. In each application, the mechanical integrity of the electrospun material ultimately plays a major role in how it will perform under end-use conditions. In this seminar, we will review the process by which fibers are formed in electrospinning, followed by discussion of their interesting mechanical properties and the fabrication of unusually stiff, strong and tough ultrafine polyethylene fibers by the process of “gel-electrospinning”. We then examine the application of electrospun fibers in the separation of oil-in-water emulsions, and efforts to mitigate fouling in such membranes.

Bio: Gregory C. Rutledge is the Lamot du Pont Professor in the Department of Chemical Engineering at the Massachusetts Institute of Technology (MIT) and the Lead PI for MIT in AFFOA, a Manufacturing Innovation Institute focused on functional fabrics. He served as Director of the Program in Polymer Science and Technology and as Executive Officer of the Department of Chemical Engineering at MIT. He is a Fellow of the American Institute of Chemical Engineers, the American Physical Society, and the Polymer Materials Science and Engineering (PMSE) Division of the American Chemical Society, and he is a recipient of The Founders Award of the Fiber Society. He was a Thinker in Residence at Deakin University in 2016. Prof. Rutledge’s research on molecular engineering of soft matter focuses on the relationships between processing, structure and properties of engineered polymers, using statistical mechanics and knowledge of their chemistry and molecular level architecture. His expertise includes both computations and experiments. Prof. Rutledge is an editor for the *Journal of Materials Science* and serves on several editorial boards.