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### Capillary-Channeled Polymer Fibers as Stationary Phases in Liquid Chromatography Separations

Clemson University is seeking companies interested in the commercialization of a novel stationary phase platform for use in liquid chromatography and solid phase extraction applications based on polymer fibers of a unique geometry that permits very efficient fluid transport and a highly reactive surface for solute interaction. Capillary-channeled polymer (C-CP) fibers can be extruded from a wide variety of base polymers, yielding surfaces of different degrees of hydrophobicity, ionic character, and compound class selectivity. Fiber surfaces are readily modified to change hydrophobicity and permit selective species retention. The fiber geometry is such that very efficient mass transfer occurs while also permitting very high volume flow rates at minimal backpressures. C-CP fiber columns can be prepared in a wide variety of formats including single fibers within microfluidic channels, microbore capillaries, common analytical sizes, and preparative-scale assemblies. In addition to a high degree of chemical diversity and very favorable fluid transport characteristics, the fiber material is relatively inexpensive in comparison to conventional column packing materials.

#### Applications:

- ◆ Reversed-phase, ion exchange, and hydrophobic interaction chromatography
- ◆ High speed protein separations
- ◆ Stationary phases for microfluidic devices
- ◆ Preparative-scale separations with analytical-scale pumping requirements
- ◆ Selective immobilization of target molecules

#### Advantages:

- ◆ C-CP fiber surface area 3X that of conventional fibers of like diameter
- ◆ Very high column permeabilities, allowing high volume flow rates
- ◆ Very short (<10 μm) inter-fiber diffusion distances
- ◆ Wide variety of base polymer chemistries and potential modifications
- ◆ Highly efficient fluid transport, including inherent self-wicking
- ◆ Immunity to mass transfer limitations encountered in porous particle phases
- ◆ Ready implementation in a wide variety of column formats
- ◆ Patented fiber production technology owned by Clemson University
- ◆ Local fiber development and production capabilities
- ◆ Film and monolith structures also under development

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## Meet The Inventors:

### *R. Kenneth Marcus:*

Dr. Marcus earned B.S. degrees (1982) in chemistry and physics from Longwood College and a Ph.D. (1986) in analytical chemistry from the University of Virginia. Since joining the Clemson faculty in 1986, Dr. Marcus has graduated over 30 Ph.D. and MS students in research that has continually been focused on analytical instrumentation development. That work has resulted in ~10 US and international patents and over 125 journal publications. He serves on the editorial advisory board for four international journals and was the recipient of the 2001 S.C. Governor's Award for Excellence in Science Research.

### *Philip J. Brown:*

Dr. Brown, an assistant professor in the School of Materials Science and Engineering at Clemson University, joined the faculty in January 2002. He earned a BSc in 1987 and received a Ph.D. from the School of Textile Industries in Leeds in 1991. After a few years research work, including 1.5 years at Herriot Watt University as a teaching/research fellow, he went back to Leeds as a lecturer in the School of Textile Industries.

Dr. Brown's current research interests include, but are not limited to, fiber spinning and the production of deep groove capillary surface channeled fibers, fabrication of polymeric photonic crystal fibers, the production and properties of hollow fiber membranes including examination of phase inversion conditions. In addition to the dry jet wet and wet spinning of fibers, he is interested in electrospinning of fibers and nanofibers. Additional interests are in the broader areas of dyeing and finishing, including self cleaning fabrics/ultrahydrophobic surfaces and fibers, the crosslinking of synthetic fibers and the application of UV laser radiation to textile substrates.

### *Igor Luzinov:*

Dr. Luzinov received a M. S. degree in Chemical Engineering and Technology in 1985 and a Ph. D. degree in Polymer Chemistry in 1990 from Lviv Polytechnic Institute (Ukraine). Prior to joining the faculty of Clemson University, he served as a Senior Research Scientist at Physical Chemistry Institute (National Academy of Science of Ukraine), NATO Research Fellow at Center Education and Research on Macromolecules (University of Liege, Belgium) and Postdoctoral Research Associate at Iowa State and Western Michigan Universities.

Since joining the Clemson faculty in 2000, Dr. Luzinov has graduated 4 students (1 Ph.D. and 3 MS) in research that has continually been focused on surface modification of various substrates. The main goals of the program are to develop the synthetic approaches that will enable assembly of submicron polymer films with desired structures and properties.

*The Clemson University Research Foundation (CURF) is a 501(c)(3) corporation supporting research, technology transfer, and business incubation at Clemson University. For more information about CURF, see our website at [www.clemson.edu/curf](http://www.clemson.edu/curf).*