High throughput Atmospheric Pressure Atomic Layer Deposition on Polymers and Fibers

Our research group explores chemical reactions during vapor phase atomic layer deposition (ALD) and related molecular layer deposition (MLD) processes to prepare nanoscale thin film semiconductors, metals, insulators, and polymers for electronic, structural, protective and other applications. We find that ALD offers unique opportunities in surface and materials engineering for advanced manufacturing. For example, we find that a low-cost chemically inert polymer such as polypropylene can be conformally coated with a nanoscale ceramic that makes it chemically functional without changing the material's flexibility or weight. We also find that vapors can infuse into some polymers and react with functional groups in the polymer backbone or sidechain to modify the physical and chemical structure of the polymer. This allows us, for example, to integrate metal organic framework (MOF) solids onto polymer fibers to absorb and decontaminate harmful vapors, and to stabilize supported molecular catalysts for water oxidation. As part of our program, we are working under NSF funding to identify and target challenges in process scaling, including high throughput processing at atmospheric pressure. This presentation will include an overview of ALD surface reaction chemistry and describe progress toward nanomanufacturing solutions.

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Gregory N. Parsons is a Professor of Chemical and Biomolecular Engineering at North Carolina State University and a Visiting Senior Fellow at Research Triangle Institute, Research Triangle Park, NC. He received a PhD in Physics from NC State University in 1990, and did post-doctoral work at IBM TJ Watson Research Center, Yorktown Heights NY from 1990 to 1992. He joined NC State Chemical Engineering in 1992. In 2006 he launched NC State University's Nanotechnology Initiative to address fundamental understanding of nanomaterials and nanoscale processing. Professor Parsons' research focuses on surface chemistry and chemical processing of thin film materials by atomic and molecular layer deposition, including investigations of nanoscale surface chemistry on polymers and fibrous media, and applications in renewable energy generation and storage. He has published more than 150 research articles and received several awards for his research. He is a Fellow of the American Vacuum Society and was named in 2009 to NC State's Academy of Outstanding Teachers.

