UNH Materials Science Seminar

11:10-12:00, Thursday, December 11, 2008
DeMeritt Hall 238
University of New Hampshire

Materials Technologies for Next Generation Chemical and Biological Protective Clothing

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Selectively permeable membranes (SPMs) are widely used throughout the chemical industry for carrying out gas separations, in the purification of water by reverse osmosis, and in medical applications such as kidney dialysis. For the past decade, some of these SPMs have been engineered for novel use in lightweight clothing for protection against hazardous chemicals and agents of biological origin. These SPM technologies were demonstrated to function without the use of an activated carbon layer to adsorb toxic vapors, and they have been developed and extensively evaluated to protect individual soldiers and emergency responders while remaining comfortable and flexible textile systems. SPM based fabric systems continue to be field evaluated for use in different operational scenarios. In general, promising SPMs have been laminated in between outer shell and liner fabrics, and fabricated into prototype chemical and biological protective garments. They were then exposed and tested for their protective performance in rain, water immersion, aerosol, and chemical vapor contaminated environments. After successful system-level testing, they were also tested in limited field experiments for subjective comfort and durability. Overall user input from several limited field experiments has indicated overwhelming preference for SPM based fabric systems over current chemical protective clothing systems. At this time new, complimentary technologies are being developed, and some of these will be discussed in this paper. These include: sulfonated ionomer-based SPMs for improved evaporative cooling; ion implantation process to optimize perm-selectivity and resistance to toxic industrial chemicals; perforated, self-assembled molecular pore based SPMs; reactive materials for self-detoxification of chemical warfare agents; biocide additives for instant kill of biological warfare agents (i.e., bacteria and viruses); elastomeric SPMs for self-conformable clothing; and novel closure systems for integrated protection. Emerging super-oleophobic coating technologies will also be briefly discussed because of its promising applications in military clothing. This seminar will include discussions on mechanical, barrier, and moisture vapor transport properties of selected SPM's as well as on new and complementary technologies.

Mr. Quoc Truong is a Physical Scientist at the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC). His research interests includes

permeation studies of organic solvents through polymeric membranes, superoleophobic coatings, surface chemistry/modifications, developments of environmental, chemical and biological (CB) protective clothing, amphibious land/sea-operation suits based on the use of selectively permeable materials, novel closures/interfaces for CB protective clothing, elastomers, barrier materials, reactive/sorptive semipermeable materials, smart temperature responsive shape memory polymer membranes, and specialty insulation materials. He is recognized as the pioneer of the breakthrough technological development of non-carbon based selectively permeable membranes (SPM), which represents the future direction of CB protective clothing. SPM based CB duty uniform (CBDU) was submitted as a candidate for Army Materiel Command Top 10 Inventions in Dec 2003. He has received numerous awards for his R&D contributions in individual protection, including 2001 US Army R&D Achievement Award. He was one of six federal employees who were profiled and highlighted at the Association of the United States Army Annual Meeting in 2003. Mr. Truong received his BS and MS degrees in Plastics Engineering from UMass Lowell in 1984 and 1999 respectively. He had completed required courses for UMass Lowell's Doctor of Engineering program's in Plastics Engineering in 2006.

Host: Professor Marshall Ming x1446