Poster Session (Magnolia Prefunction)

Posters displayed:
April 9, 2:00 – 8:00 p.m.; April 10, 7:30 a.m. – 7:15 p.m.
Presenters in attendance:
April 10, 5:45 – 6:45 p.m.

Effect of Processing Conditions on the Structure, and Properties of Melt Blown Polylactic Acid (PLA) Nonwovens - **Homeira Azari**, University of Georgia

A commercially available PLA being developed for melt blowing application was processed under various conditions and with a processing aid using a melt blowing pilot line. Produced nonwoven samples were studied by scanning electron microscope (SEM), capillary flow porometer, absorbency and air permeability testing system. In addition, the physical and mechanical properties of nonwoven fabrics were determined. A detailed analysis of the influence of the processing conditions on the microstructures of PLA fibers showed the importance of an additive, as well as process air pressure and throughput rate on fiber diameter and diameter distribution. Results indicate that a decrease in fiber diameter and diameter distribution can be achieved by the addition of an additive at low processing air pressures.

Wash Lifespan Analysis of Surgical Gown Durability Concerning Impact Penetration and Hydrostatic Pressure - **Alex D. Cao** (presenter), Meredith McQuerry, and Elizabeth Easter, Florida State University

The Ebola virus claimed the lives of over 11,000 people including 500 healthcare personnel. Surgical gowns worn while treating patients with Ebola surfaced to be defective, allowing bodily fluids to permeate the gowns, ultimately infecting the wearer. This research evaluated the environmental impact of disposable versus reusable surgical gowns by assessing their ability to provide adequate protection
across their lifespan, per AAMI (Association for the Advancement of Medical Instrumentation) specifications. Gowns were tested for water resistance and hydrostatic pressure, along with other durability assessments (dimensional stability, colorfastness, abrasion, strength, etc.) according to standard AATCC test methods. Data was collected at new for the disposables and after 1, 25, 50, and 75 industrial launderings for the reusable gowns. Results were compared to AAMI PB70 performance specifications.

Electrospinning Polypyrrole for Novel Carbon Dioxide Sensors: A Study of Electrospinning Parameters for Highly Sensitive and Conductive Nanofibers - **Ashwariya Lahariya** (presenter) and Jintu Fan, Cornell University

*Sensitive and inexpensive CO2 sensors comparable to commercial CO2 sensors in performance are made using conducting polymer-Polypyrrole (PPy). PPy nanofibers 100-400 nm in diameter showing conductivity in the range of 3.66*10-3 S/m-7.04*10-3 S/m were produced using electrospinning process. Stable, doped polymer dispersion of PPy and Polyethylene Oxide (PEO) as a carrier were used for electrospinning. Eight electrospinning parameters were studied to optimize the collection of highly conductive and sensitive PPy nanofibers; with high surface area suitable for CO2 sensitivity. SEM, TEM, Four-probe conductivity measurement and elemental analysis were used to characterize the nanofibers. Laboratory scale set-up was used to measure sensitivity to CO2. PPy being a conducting polymer holds potential to be used in gas sensing and electronic applications in nanofiber form.*

Environmentally Sustainable and Industrially Reliable Textile Dyeing Technology from Fibrillated Nanocellulose - **Anuradhi Liyanapathiranage** (presenter), Ian R. Hardin, Suraj Sharma, and Sergiy Minko, University of Georgia; Igor A. Luzinov, Clemson University; Paula F. De Castro and Dmitry G. Shchukin, The University of Liverpool, United Kingdom

Fibrillated Nanocellulose (NFC) is a nontoxic, one-dimensional (1D) polysaccharide engineered from cellulose sources. NFC exists as a hydrophilic hydrogel, displaying thixotropic behavior and high colloidal stability. Due to such structural significances [1], NFC efficiently carries dye molecules to the textile surface, ensuring their permanent retention by forming stable physical bonds.

NFC dyeing technique is a reliable green production solution to address current challenges in the textile dyeing industry because it:

• Exhibits excellent dye performances compared to the conventional exhaust dyeing method.
• Reduces production cost and saves dye, water, and energy consumption [2].
• Has the flexibility of dyeing versatile fabrics using different dye systems.
• Delivers more than 85% dye fixation when optimized using chemical crosslinking post-treatments.
• Has the potential to use for novel dye deposition methods.

Moreover, the synthesized dyes when formulated into inks, exhibit excellent absorbed dye fixation and outstanding color fastness to light and wash along with excellent ink storage stability.

Cosmetic Application of Textiles: Micro-encapsulation of Vitamin A Palmitate by Melt Dispersion Method - **Aditi Nandy** (presenter), Eliza Ayton, Suraj Sharma, University of Georgia

Cosmetic textiles based on microencapsulation technology has been a less explored arena of textiles research. The objective of our study was to encapsulate Vitamin A-palmitate by melt dispersion technique to impart skin-care properties through capsule loaded textiles. The method was effective in producing microparticles with spherical shape and size distribution less than 100µm. We characterized the microparticles for size using SEM; loading capacity and encapsulation efficiency using Ultraviolet-visible spectroscopy; and evaluated antioxidant activity through DPPH (2,2-diphenyl-1-picrylhydrazyl)
assay. We could achieve 15.9% apparent loading on average with expected loading capacity 25%. The encapsulation efficiency ranged from 61%-75%. Vitamin A leached from the capsules typically within 3-5 days, suggesting low shelf life. For 25% expected lading capacity, antioxidant activity of Vitamin A was 5.6% on average.

Sustainable Nanocellulose Dyeing Technology for Cotton/Polyester Blended Textiles - **Smriti Rai** (presenter), Suraj Sharma, and Sergiy Minko, University of Georgia

Traditionally, dyeing of cotton/polyester blend consists of a two-step process and is very water and chemical intensive. In this study, a combination of reactive and disperse dyes in a one-step dyeing process with the nano-fibrillated cellulose hydrogel was used to coat cotton/polyester blend (50/50) fabric. Nanocellulose gel acts as an anti-migrating agent for disperse dye for sublimation on polyester fibers, while the reactive dyed nanocellulose gets deposited over the cotton fibers, uniformly coloring the whole fabric in a one-step process. This coated fabric was subjected to post-treatment of chitosan with itaconic acid and sodium hypophosphite, which aided the fixation of dyed nanocellulose gel to the fabric and is also expected to impart antimicrobial and antiwrinkle properties. The results also showed comparable dyeing properties while using significantly less amount of water and chemicals.

Analysis of Fireground Contamination of Firefighter Personal Protective Equipment - **Adhiraj Shinde**, North Carolina State University

Firefighters have a 9% higher risk of contracting cancer than the general US population. Contaminated turnout gear and ensemble elements have potentially carcinogenic compounds such as Polycyclic aromatic hydrocarbons (PAH's), Perfluorinated compounds (PFOA's), flame retardants, phenols and phthalates. Identification and separation of toxic compounds is being done through GC-MS, HPLC, UV-VIS and FTIR techniques. Highly functional methods such as radiant off-gassing and contact transfer are being used to assess the hazards posed by the transfer of the chemicals upon contact with skin by measuring the volatiles surfacing out of firefighting garments, gloves and hoods. The aim is to maximize the removal of contaminants from the gear by about 80-90%. This is being achieved through several techniques, including supercritical carbon-dioxide as an advanced de-contamination technique.

Barrier and Mechanical Properties of Composite Nonwovens Produced from Hydroentangling Cotton Fibers with Elastomeric Webs - **Partha Sikdar**, University of Georgia

Non-woven products continue to grow because of their unique structure, properties and flexibility to engineer their properties. Elastomeric polymers such as polyurethanes and olefin copolymers provide stretchability and can be converted to melt blown/spunbonded webs. Current research is

to produce elastomeric non-wovens containing cotton by appropriate process combinations such as meltblowing/spunbonding and hydro-entangling. Adding cotton into elastic webs enhances the performance such as absorbency and comfort of synthetic fiber products. The webs and laminated structures produced by various combinations are evaluated for their physical properties such as weight, thickness, permeability, porosity, tensile and bursting strength, and absorbency. Also, stretchability and stretch recovery of the webs are determined using cyclic loading and unloading tests. Results from this ongoing study will be presented.