ACS-GHS April 2024 Seminar
Dr. Jaime Grunlan

Tuesday, April 30th
6:30 - 7:30 pm
via Zoom

Register to receive the meeting link at https://acsghs.wildapricot.org/event-5648626

Protective Nanocoatings from Polyelectrolytes: Flame Retardancy, Super Gas Barrier, and High Voltage Insulation

Layer-by-layer (LbL) assembly is a conformal coating "platform" technology capable of imparting a multiplicity of functionalities on nearly any type of surface in a relatively environmentally friendly way. At its core, LbL is a solution deposition technique in which layers of cationic and anionic materials (e.g. nanoparticles, polymers and even biological molecules) are built up via electrostatic attractions in an alternating fashion, while controlling process variables such as pH, coating time, and concentration. Here we are producing nanocomposite multilayers (50 – 1000 nm thick), having 10 – 96 wt% clay, that can be completely transparent, stop gas permeation, impart extreme heat shielding to carbon fiber reinforced polymer composites. Similar films exhibit very high dielectric breakdown strength. In an effort to impart flame retardant behavior to fabric using fewer processing steps, a water-soluble polyelectrolyte complex (PEC) was developed. This nanocoating is comprised of polyethylenimine and poly(sodium phosphate) and imparts self-extinguishing behavior to cotton fabric in just a single coating step. Adding a melamine solution to the coating procedure as a second step renders nylon-cotton blends self-extinguishing. A PEC of PEI and polyacrylic acid is able to achieve an oxygen transmission rate below 0.005 cm^3/m^2/day at 100%RH and a thickness of just 2 mm. These coating techniques can be deposited using roll-to-roll processing (e.g., flexographic printing, dip-coating, or spray-coating). Opportunities and challenges will be discussed. Our work in these areas has been highlighted in *C&EN*, *ScienceNews*, *Nature, Smithsonian Magazine, Chemistry World* and various scientific news outlets worldwide. For more information, please visit my website: http://nanocomposites.tamu.edu

Biography: Dr. Jaime Grunlan is the Leland T. Jordan '29 Chair of Mechanical Engineering at Texas A&M University, where he has worked for more than 20 years. He holds joint appointments in the Department of Materials Science and Engineering and the Department of Chemistry. His research focuses on thermal and transport properties of polymer nanocomposites. He is a world leader in organic thermoelectric materials, super gas barrier layers, and environmentally-benign, flame retardant nanocoatings. He holds 16 issued U.S. patents and several EU patents. He has published more than 200 journal papers, with more than 26,000 citations. Dr. Grunlan has graduated 29 PhD students and has mentored more than 50 undergraduate students in his research laboratory. His work has been highlighted in *Smithsonian Magazine, Nature,* and the *New York Times*. He is an Editor of the *Journal of Materials Science* and *Progress in Organic Coatings*, and Associate Editor of *Green Materials*. In 2018, Prof. Grunlan became a Fellow of the American Society of Mechanical Engineers (ASME) and was awarded a *doctorate honoris causa* (i.e. honorary doctorate) from the University of South Brittany (Lorient, France). In 2019, he became a Senior Member of the National Academy of Inventors (NAI). In 2023, he became a Fellow of the American Chemical Society (ACS). In 2024, he became a Fellow of the American Chemical Society Division of Polymeric Materials: Science and Engineering (PMSE).