

Introducing CAPCE Researchers

Dr. **Avi Benatar** is an Associate Professor and Director of the Plastics and Composites Joining Laboratory in the Department of Industrial, Welding & Systems Engineering. His research interests include: ultrasonic processing of materials, rapid heating and curing of adhesives, mechanical joining of plastics and composites, and welding of plastics and composites. Dr. Benatar and his graduate students developed the first comprehensive model for ultrasonic welding of plastics and they pioneered microwave and radio frequency welding using conductive polymers. Just recently, Dr. Benatar and Dr. L. James Lee began collaborative studies on the development of new techniques for joining micro and nano-scale components and the use of high power ultrasonic energy to enhance the processing of nanocomposites.



Dr. **John Lannutti** is an Associate Professor in the Department of Materials Science and Engineering. His interests in polymer composites stem from the application of his background in sol-gel chemistry to create nanoporous silica reinforcements for thermosetting matrices (patent granted). To date, these particulates have been superior to clays in many categories, particularly rheology. Increases in toughness, wear resistance and strength have been reported

using widely different polymer matrices. CAPCE-related activities focus on polystyrene, polyimide and PMMA reinforcement for auto, aerospace, and dental applications.



Dr. **Petr Svoboda's** one-year post-doctoral university fellowship at CAPCE began in July 2000. His research in cooperation with Professors Lee and Tomasko emphasizes processing and morphology evolution in supercritical fluids-enhanced polymer and composite blending. Dr. Svoboda obtained a Masters degree from the Technical University Brno, Faculty of Technology at Zlin, the Czech Republic, followed by a Ph.D. degree in 1995 at the Tokyo Institute of Technology's Department of Organic and Polymeric Materials under the supervision of Prof. T. Inoue. After graduation he served as Chief Researcher at a Czech Republic rubber company for two years, followed by a post-doctoral research appointment in Tokyo for two years.



*For more information contact CAPCE at 614-292-9271 or stevenson.2@osu.edu.
Director - L. James Lee
Associate Directors - Kurt W. Koelling and Anthony F. Luscher*

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Analysis for Pultrusion and Injection Pultrusion

By Zhongman Ding and Shoujie Li (Lee)

Experiments on the pultrusion process using different die lengths were carried out to study the contribution of resistance force in different regions along the pultrusion die. Results revealed correlations between processing variables (such as line speed and die length) and their influence on pulling force and part quality in terms of blister formation. Experimental study is underway on the friction mechanism between the die surface and the composite, to be followed by pulling force modeling. Management of heater power input was found to significantly influence part quality. Modeling and simulation with consideration of heater management and die heat transfer are being studied. The purpose is to establish a design tool for high-speed pultrusion.

In-Mold Coating of Thermoplastic Substrates

By Xu Chen, Konstantin Zuyev and Mauricio Cabrera-Rios (Castro)

Kinetics and rheological equations have been developed for a new class of coatings being developed by Omnova Solutions, Inc. as a top coat for thermoplastic substrates. The simplified model for predicting pressures was experimentally tested and a model developed to predict cure time for the coating. A method to predict fill patterns as the coating is injected is being tested. Neural network models are being developed to optimize the injection gate location. ■

Center for Advanced Polymer and Composite Engineering
The Ohio State University
121 Koffolt Laboratories
140 West 19th Avenue
Columbus, OH 43210-1180

4030-735672-361

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