



Receive hands-on training in diagnosing and solving your
additive manufacturing R&D problems!

The American Chemical Society Presents...

Polymeric Materials for Additive Manufacturing

Compelling Reasons to Register for This Course:

1. Understand Practical Uses of Additive Manufacturing Methods and the Predictive Structure-Property-Processing Relationships.
2. Design Novel Polymeric Materials with a Balance of Reactivity and Rheology for Diverse Printing Platforms
3. Work and Consult with Renowned Authorities in the Additive Manufacturing Field.
4. Acquire Hands-on Experience by Performing or Discussing a Variety of Experiments in a Small Group Laboratory Environment.
5. Gain a Remarkable Breadth of Knowledge of 3D Printing - Covering a Variety of Topics from Thermoplastic Design to Solution Rheology.
6. Solve Your Practical, Work-Related Problems by Discussing Your Work with Additive Manufacturing and Polymer Experts.

Inaugural Course offered Fall 2021:

Sunday evening – Friday noon
September 12-17, 2021

The course is held at Virginia Tech, Blacksburg, Virginia USA

Register Today at: www.ProEd.acs.org

Enrollment in this exceptionally popular course
is strictly limited to 30 participants. Sessions sell
out quickly. Don't delay!



Who Should Attend?

Anyone currently working or beginning to work with additive manufacturing and its applications, including bachelor degree through Ph.D. level research chemists, engineers, physicists, or technicians should take this course. Managers in the polymer industry will greatly benefit from this in-depth, lecture-laboratory course. No prior knowledge of additive manufacturing is assumed. Although some introductory lectures are included on polymer science and engineering, some working knowledge of polymer chemistry would be useful. This course is also ideal for K-12 teachers and university professors who wish to integrate additive manufacturing principles into their courses.

Note: Because of the amount of lab work, enrollment is strictly limited to 30 people. Each participant should bring comfortable clothing, arriving early enough on Sunday to have a meal and be well rested for the first evening session.

What You'll Learn

The fundamentals of additive manufacturing

Design of polymer structure that aligns with diverse printing platforms

Correlation of structure-property- processing relationships to accelerate innovation

Comprehensive Program Agenda

SUNDAY

4:30	–	5:00	PM	Registration
5:00	–	5:30	PM	Welcome and Outline of Course: Resolution, Rheology & Reactivity (Williams)
5:30	–	6:30	PM	Resolution: Additive Manufacturing Processes (Williams)
6:30	–	6:45	PM	Break
6:45	–	7:45	PM	Rheology: Polymer Rheology in AM Processes (Bortner)
7:45	–	8:00	PM	Break
8:00	–	9:00	PM	Reactivity: Polymer Terminology and Classes (Long)

MONDAY

8:00	–	9:15	AM	Rheology in Extrusion-Based Additive Manufacturing I (Bortner) Fused Filament Fabrication
9:15	–	9:25	AM	Break
9:25	–	10:40	AM	Thermoplastic Design and Properties (Long)
10:40	–	10:50	AM	Break
10:50	–	12:05	PM	Rheology in Extrusion-Based Additive Manufacturing II (Bortner) Fused Filament Fabrication and Direct Ink Write
12:05	–	1:20	PM	Lunch Together
1:30	–	3:30	PM	Extrusion Based AM Lab (CRC, capillary rheology and FFF)
3:45	–	4:00	PM	Break
4:00	–	5:00	PM	Structure-Property Relationships of Printed Parts (Williams)

Monday Evening Free

TUESDAY

8:00	–	9:15	AM	Photopolymerization-Based Additive Manufacturing (Williams) Vat Photopolymerization, UV-DIW, & Material Jetting
9:15	–	9:30	AM	Break
9:45	–	11:45	AM	Lab, (MMDC – chemical, physical and thermal characterization of polymers)
12:00	–	1:15	PM	Lunch Together
1:15	–	2:30	PM	Influence of Light on Viscoelasticity (Bortner)
2:30	–	2:40	PM	Break
2:40	–	3:45	PM	Structure-Property Relationships of Photo-reactive Polymers I (Long)
3:45	–	4:00	PM	Break
4:00	–	5:15	PM	Structure-Property Relationships of Photo-reactive Polymers II (Long)

Tuesday Evening Free

WEDNESDAY

8:00	–	9:15	AM	Introduction to Thermal Properties of Polymers (Bortner)
9:15	–	9:30	AM	Break
9:30	–	10:45	AM	Polymer Powder Bed Fusion Additive Manufacturing (Williams)
10:45	–	11:00	AM	Break
11:00	–	Noon		Structure-Property Relationships of SLS Materials (Long)
12:00	–	1:30	PM	Lunch Together
1:30	–	2:45	PM	Processing in SLS and Structure-Properties (Williams)
2:45	–	3:00	PM	Break
3:00	–	5:30	PM	SLS and SLA, (Goodwin Hall, DREAMS Lab)

Wednesday Evening Free

THURSDAY

8:00	–	9:15	AM	Jetting Additive Manufacturing Processes (Williams) Binder Jetting & Material Jetting
9:15	–	9:30	AM	Break
9:30	–	10:45	AM	Solution Rheology (Bortner)
10:45	–	11:00	AM	Break
11:00	–	12:15	PM	Polymers for Jetting (Long)
12:15	–	1:45	PM	Lunch Together
1:45	–	4:30	PM	Lab (Goodwin Hall, Dreams Lab)
5:00	–	7:00	PM	ACS Networking Reception, Bull and Bones, casual dress.

FRIDAY

8:00	–	9:15	AM	Emerging Topics in Printing for Additive (Williams)
9:15	–	9:30	AM	Break
9:30	–	10:30	AM	Emerging Topics in Materials Design for Additive (Long)
10:30	–	10:45	AM	Break
10:45	–	11:45	AM	Emerging Topics in Properties and Performance of Printed Objects (Bortner)

About the Faculty

Dr. Timothy E. Long joined Virginia Tech in 1999 and recently completed his five-year term as the Director of the Macromolecules Innovation Institute (MII) at Virginia Tech. He joined Arizona State University in summer 2020 to launch and lead the Biodesign Center for Sustainable Macromolecular Materials and Manufacturing, and he is jointly appointed in the School of Molecular Sciences and the School for Engineering Matter, Transport and Energy. He has been an instructor with the American Chemical Society since 2005.

Dr. Long's continuing research goal is to integrate fundamental research in novel macromolecular structure and polymerization processes with the development of high performance macromolecules for advanced technologies, (e.g., engineering polymers, sustainable feed stocks, green chemistry, adhesives and elastomers, block copolymers and living polymerization, and biomaterials for health and energy). He invokes fundamental relationships in polymer structure, physical properties, and advanced processing to accelerate innovation and impact in diverse technologies. His latest efforts relate functional polymeric material structure and physical properties to additive manufacturing modalities (3D printing).

Dr. Long spent nearly a decade as a research scientist at Eastman Kodak and Eastman Chemical Companies. He has over 50 patents in the field of macromolecular science and engineering, published 22 book chapters, and has recently exceeded 350 peer-reviewed publications.

He has received many prestigious honors in his field of polymer chemistry recently, including:

- Virginia Outstanding Scientist Award (2015)
- Virginia Outstanding Faculty Member (2020)
- Inducted as AAAS Fellow, ACS Fellow, and ACS POLY Fellow
- American Chemical Society (ACS) PMSE Cooperative Research Award
- ACS POLY Mark Scholars Award
- Pressure Sensitive Tape Council (PSTC) Carl Dahlquist Award (2011)
- Virginia Tech's Alumni Award for Research Excellence (2010)
- Invited organizer of the Gordon Research Conference – Polymers, and Chair, ACS Polymer Division
- Invited organizer of the 2012 IUPAC Macro Congress at Virginia Tech

Dr. Long received his B.S. in 1983 from St. Bonaventure University, followed by his Ph.D. in 1988 from Virginia Tech.

Dr. Michael J. Bortner is an assistant professor in the Department of Chemical Engineering at Virginia Tech University.

Dr. Bortner has a decade of industry experience working in polymer and composite materials and process development. He was a Senior Process Engineer at Nuvotronics and a VP of Manufacturing Process Development at NanoSonic before returning to Virginia Tech as a Professor in the Department of Chemical Engineering.

Dr. Christopher Williams is a Professor and the Electro-Mechanical Corporation Senior Faculty Fellow in the Department of Mechanical Engineering at Virginia Tech. He is Director of the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory, and Interim Director of the Macromolecules Innovation Institute at the University. He has conducted research in Additive Manufacturing for over 20 years, and has published over 160 peer-reviewed articles that span the entire value chain of Additive Manufacturing, including design for AM methodologies, novel AM processes and materials, and cyber-physical security.

Course Fee

Check the ACS website to see current member and non-member pricing
www.ProEd.acs.org

Course Location

All lectures are typically held at the **Inn at Virginia Tech**, second floor. Laboratory sessions are held in the DREAMS Lab in Goodwin Hall, the Macromolecular Materials Discovery Center(MMDC) on VT campus, and the Polymer Composite and Materials Laboratory at the VT Corporate Research Center. A guide will escort participants to labs. In case of inclement weather, a van will be provided at the front door of The Inn immediately following lecture.

Lodging Information

The guestroom blocks will be held until one month before each session. To ensure that you are able to book a room at this special rate, we urge you to make your hotel reservation as soon as possible, mentioning that you are an American Chemical Society short course participant. Please check the ACS website for the course location, or contact the MII administration at mii@vt.edu.

The closest airport is in Roanoke, VA, about 45 minutes drive from Blacksburg. For those wishing to rent a car, all major rental car agencies have facilities at the Roanoke Airport. Alternatively, bus service is available through Smart Way Bus (www.smartwaybus.com) which will bring you directly to the Virginia Tech campus.

Payments/Cancellations

All registrations must be prepaid. You may register online or via mail. Please go to the ACS website for full registration instructions.

If you need to cancel your enrollment, you may do so up to ten (10) business days before the session and still receive a refund of your registration fee, minus a \$50 administration fee. The specific cancellation date will be provided in your confirmation letter. After that time, no refund or credit will be issued but you may have a co-worker attend in your place.

See you in Blacksburg!



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