

The Blue Ridge Chemist

The Blue Ridge Chemist, since 1947 the
Official Local Section Publication of the
Virginia Blue Ridge Section, American Chemical Society



VOLUME LXV

September 27, 2012

No. 5

AIChE

American Institute of Chemical Engineers

Joint Meeting

ACS

American Chemical Society

ETS, Inc. Hosts September Meeting

<http://www.acs-vbrs.org>

VIRGINIA BLUE RIDGE SECTION AMERICAN CHEMICAL SOCIETY

649th SECTION MEETING

Hosted by ETS, Inc.

Thursday, September 27, 2012

PROGRAM:

- 5:30-6:00 Social Time, ETS Training Room
- 6:00-7:00 Dinner, ETS Training Room
- 7:00-8:00 Talk, ETS Training Room

The social time, dinner, and meeting will all take place in the Training Room at ETS, Inc. (see the map on page 7). This will be a joint meeting of ACS with AIChE. The speaker will be Frank Higgins speaking on "FTIR Polymer Analysis Using Multiple Sampling Techniques".

The meal will be catered by Szechuan Restaurant and will be a Chinese buffet with vegetarian options. The dinner is \$14, with students and retired members being half price.

Reservations for the meal must be made by Thursday, September 20. ACS people can make them by phoning Dr. Kim Lane at 540-831-5422, or e-mail to ktlane@radford.edu, or regular mail to Reed Hall 0357, P.O. Box 6949, Radford University, East Main Street, Radford, VA 24142. AIChE people can make them by phoning Christina Clark (540) 265-0004 ext. 216, or by e-mail to christinac@etsi-inc.com, or by mail to ETS, Inc., 1401 Municipal Road, NW, Roanoke, VA 24012.

Frank Higgins
Owner/ Operator, FTIR-Analysis.com
Naugatuck, CT

Frank Higgins received his Bachelor of Science degree in biology, with a chemistry concentration, from Florida Southern College in 1998. After college, Frank's chemical and physical materials research experience started in the analytical department at Cytec Industries. This role included advanced training and mentorship by Norman Colthup, author of the original "Colthup Chart", in the focused area of vibrational spectroscopy and interpretation of mid-infrared and Raman spectra. In 2002 Frank became the lead vibrational spectroscopist for the Stamford R&D Labs at Cytec. Expertise was developed in creating novel FTIR analysis methods and applications for a variety of products, including liquid paint resins, water soluble polymers, and polymer additives. In 2007, Frank moved into the portable and handheld FTIR instrument industry through employment with A2 Technologies (now Agilent Technologies) as an Applications Development Scientist. Frank's work at A2 paired spectral interpretation skills, methods development, and mechanical skills into a diverse role including geology, environmental, composite, fuel and oil, gas, and surface coating applications. Currently, thermal damage of composites and polymer analysis is a priority area being studied and developed for mobile FTIR spectrometers.

In 2010 Frank started an online infrared consulting service at FTIR-Analysis.com. This service provides advanced infrared spectroscopic interpretation, methods development, and sample analysis. This service fills the infrared analytical needs of scientists, engineers, and other professionals that may not have access to a full analytical department or vibrational spectroscopist. Frank is a vibrational spectroscopist and analytical research chemist, whose e-mail is: fhiggins@ftir-analysis.com.

FTIR Polymer Analysis
Using Multiple Sampling Techniques

Fourier transform infrared spectroscopy (FTIR) is ideally suited for polymer analysis. FTIR polymer analysis provides detail rich information of polymer structure, crystallinity, orientation, additives, copolymer concentrations, and fingerprint identification. Other spectroscopic techniques require the polymer to at least partially dissolve in solvent (NMR) or require laser ablation in order to ionize the polymer for mass spectroscopy. Many high molecular weight or high performance polymers won't dissolve in solvents, making NMR and MS techniques very difficult or impossible.

The difficulty with FTIR is often sample preparation and interpretation of the results. FTIR libraries can often be used to identify pure or common mixtures of polymers, but fail to give useful information of polymers with defects or contaminations. Library searching is a bulk analysis technique and not well suited for analysis of additives or small differences in polymers. Interpretation of IR spectra can be a steep learning curve, but functional group analysis and correlation charts can be used in tandem with library searching to characterize unique or new synthesis samples. Some examples of library searching and further interpretation of polymer residues will be presented.

Modern high performance polymers such as polyphenylene sulfide (PPS), para-aramid (Kevlar™, Nomex™), and Teflon™ are being used in harsh environments, such as filter medias for utility boiler baghouse applications. FTIR analysis of PPS and other fiber felt materials can be challenging, since individual fibers or fiber bundles are difficult to handle. The simplest infrared analysis technique for such fibers is attenuated total reflectance (ATR). The polymer fibers are pressed onto an ATR crystal such as diamond, once optical contact is achieved the spectrum is acquired. However, ATR sampling accessories or dedicated instruments typically have

relatively short pathlengths (2-10um), which is too short to measure trace differences or additives. In such cases the polymer needs to be melted into a thin film, about 40-200um, for transmission FTIR sampling. In some cases fibrous polymer materials can be measured using diffuse reflectance (DR) techniques. Diffuse reflectance can measure fiber mats or felts, such as media filters, nondestructively with no sample preparation. This technique can be very useful for detecting oxidation and foreign contamination in the polymer. FTIR analysis of polymer powders and pellets can also be hot press molded into thin films for transmission FTIR analysis. However, diffuse reflectance or ATR can yield characterization data without the sample preparation. Multiple bounce ATR can be used to measure additives in polymers. Phthalates in PVC toys are measured with a diamond 3 bounce ATR with a nominal pathlength of 8 μm . Examples of each technique will be shown along with interpretations and comparisons of several polymers with the same technique and with different sampling methodologies.

AIChE's ChemE on Demand

AIChE's ChemE on Demand is a multimedia digital library containing hundreds of on-demand webinars and recorded conference presentations. This convenient resource is designed to meet your needs as a chemical engineer. AIChE professional members are entitled to 6 FREE 'credits', good for content in ChemE on Demand each year. Undergrad student members get free unlimited access to ALL ChemE On Demand content.

National Chemistry Week

The theme of this year's National Chemistry Week is "Nanotechnology: The Smallest BIG Idea in Science!". This celebration will explore the positive impact of chemistry as it relates to materials and technology in everyday life. The mission of NCW is to reach the public, particularly students, with positive messages about chemistry and to provide a means of effectively mobilizing ACS local sections.

When former ACS President, George Pimentel, conceived the idea of celebrating National Chemistry Day in 1987, he never could have predicted where his idea would lead. From a one-day celebration, National Chemistry Day grew into National Chemistry Week.

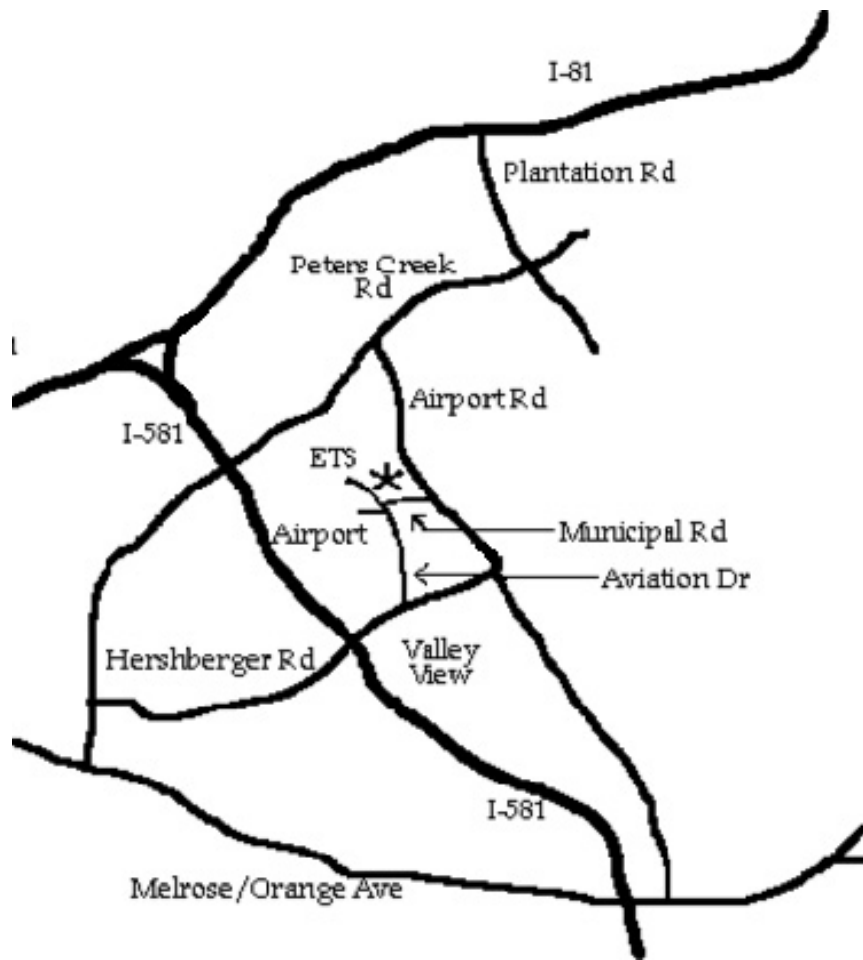
NCW encourages chemists and chemistry enthusiasts to build awareness of chemistry at the local level. Local Sections, businesses, schools, and individuals are invited to organize or participate in events in their communities with a common goal: To promote the value of chemistry in everyday life. We are excited to partner with the Nanoscale Informal Science Education Network (NISE Net).

The Virginia Blue Ridge section again is participating in the K-12 poetry contest. This illustrated poem contest is focused on "Nanotechnology: The Smallest BIG Idea in Science!" Participants are encouraged to illustrate concepts related to the nanotechnology theme as they relate to the environment, energy, materials, and health. The illustrated poems could relate to common applications of chemistry that people might not normally think is related to chemistry. Please send your entries to Kim Terry at Reed Hall 0357, P.O. Box 6949, Radford University, East Main Street, Radford, VA 24142, or drop them at her office. The deadline for receipt of entries is 5:00 p.m., Monday, October 22.

Directions to ETS, Inc.

ETS is located near the Roanoke Regional Airport, at 1401 Municipal Rd., NW. There are various ways to get to there, none easy to describe. Possibly the easiest way is to follow the signs from I-581 to the airport. When the entrance to the airport is on your left, Municipal Rd. will be the next road on the right.

Map to ETS, Inc.



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The October meeting is being scheduled for the last week in October at Ferrum College. The speaker will be Dr. Laura Grochowski with the talk entitled "Accessing the Chemical Potential of the Metagenome in the search for New Medicines". The contact person is Natalia Smelkova.