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AVANT Institute Symposium
December 13, 2019

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agenda

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AVANT Institute Symposium

elevating consumer experience: connecting rheology, consumer science and formulation architecture

December 13, 2018
Ashland - 1041 U.S Highway 202/206 - Bridgewater, NJ, USA

8:30 - 9:00am	registration / breakfast
9:00 - 9:10am	opening remarks Osama Musa, Senior Vice President and Chief Technology Officer Ashland, Bridgewater, NJ - USA
9:10 - 9:55am	dynamics, flow, and stability of emulsions and foams Prof. Vivek Sharma, Dept. of Chemical Engineering University of Illinois, Chicago, IL - USA
9:55 - 10:40am	using FT rheology to build texture Dr. Seher Ozkan, Dept. of Materials Science Ashland, Bridgewater, NJ -USA
10:40 - 11:00am	break/posters
11:00 - 11:45am	predicting skin sensory properties of cosmetics by instruments - from "pick-up", "rub-out" to "after-feel" Dr. Xin Qu, Global R&D Lab Manager Ashland, Shanghai - China
11:45 - 12:30am	hacking your competitors' products with rheology and tribology profiling Neil Cunningham, Founder and CEO Centre for Industrial Rheology, Warnford - United-Kingdom
12:30 - 1:30pm	lunch/personal care texture bar
1:30 - 2:15pm	hair conditioner - it is all about rheology Dr. Coralie Alonso, R&D Manager, Hair Care Ashland, Zwijndrecht - Netherlands
2:15 - 3:00pm	rheological fingerprinting of skin care formulations: insights into sensorial behavior Dr. Roger McMullen, Principal Scientist and Dr. Hani Fares, Senior Director, R&D Care Specialties Ashland, Bridgewater, NJ - USA
3:00 - 3:15pm	break / posters
3:15 - 4:00pm	sensory drivers of consumer liking Prof. Jean-Xavier Guinard, Dept. of Food Science University of California, Davis, CA - USA
4:00 - 4:15pm	closing remarks Osama Musa, Senior Vice President and Chief Technology Officer Ashland, Bridgewater, NJ - USA
4:15 - 5:00pm	beer taste foam experience

abstracts

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dynamics, flow, and stability of emulsions and foams

Prof. Vivek Sharma
Dept. of Chemical Engineering
University of Illinois, Chicago, IL - USA

We pursue an understanding of molecular and macromolecular principles that are critical for understanding and controlling the three desirable attributes – stability, lifetime and rheology of foams (and emulsions).
Foam films typically consist of fluid sandwiched between two surfactant laden surfaces that are ~ 5 nm - 10 microns apart, and the drainage in films occurs under the influence of viscous, interfacial and intermolecular forces, including disjoining pressure. Drainage in foam film formed by surfactant concentrations above the critical micelle concentration proceeds in a non-monotonic, step-wise fashion called stratification in contrast to the monotonic thinning exhibited by films containing no micelles.
In reflected light microscopy, stratifying films display regions with distinct shades of grey implying that domains and nanostructures with varied thickness coexist in the thinning film. Understanding and analyzing such nanoscopic thickness transitions and variations have been long-standing experimental challenge due to the lack of technique with the requisite spatio-temporal resolution, and theoretical challenge due to the absence of models for describing hydrodynamics in stratified thin films.
Using interferometry, digital imaging and optical microscopy (IDIOM) protocols we developed recently, we show that the nanoscopic thickness variations in stratifying films can be visualized and analyzed with an unprecedented spatial (thickness ~ 1 nm, lateral ~500 nm) and temporal resolution (< 1 ms).
Stratification proceeds by formation of thinner domains that grow at the expense of surrounding films. Using the exquisite thickness maps created using IDIOM protocols, we provide the first visualization of nanoridges as well as mesas that form at the moving front around expanding domains.
We measure the non-DLVO supramolecular oscillatory surface force contribution to disjoining pressure as a function of thickness.
Most significantly, we develop a self-consistent theoretical framework, a nonlinear thin film equation model that explicitly accounts for the influence of supramolecular oscillatory surface forces, and physicochemical properties of surfactants, we show the complex spatio-temporal evolution of nanoridges and domains can be modeled quantitatively. Many aqueous foams contain watersoluble polymers in addition to surfactants, and the influence of polymer properties (like chemistry, molecular weight, concentration, charge, flexibility) on the stratification dynamics as well as foamability and foam rheology are relatively poorly understood.
The formation of bubbles and drops, drainage within thin liquid films and foam rheology are influenced by response to both shear and extensional flows. However, the characterization of the response to extensional flows requires bespoke instrumentation not available, or easily replicated, in most laboratories.
Here we show that the dripping-onto-substrate (DoS) rheometry protocols that involve visualization and analysis of capillary-driven thinning and pinch-off dynamics of a columnar neck formed between a nozzle and a sessile drop can be used for measuring extensional viscosity and extensional relaxation time of polymeric complex fluids.
Using unprecedented experimental insights obtained from DoS rheometry and IDIOM protocols, we elucidate the role of polymer flexibility, extensibility and charge, polymer-surfactant interactions, stretched polymer physics, as well as DLVO and non-DLVO surface forces, and highlight the possibility and challenges for molecular and macromolecular engineering of foams.

using FT rheology to build texture

Dr. Seher Ozkan
Dept. of Materials Science
Ashland, Bridgewater, NJ – USA

Phenomenological linear rheological data capturing the material response provides valuable analytical tools to understand the architecture or spatial configuration of the microstructural components at rest. But, linear data representing "at rest" properties are not appropriate to describe the textural experience during large and fast deformations of daily consumer applications. Recently, an alternative non-linear rheological technique, named as Large Amplitude Oscillatory Shear (LAOS), has been utilized to capture the textural expression perceived by the consumer. Lissajous plots generated from the LAOS experimental data provide fingerprints of the materials. These fingerprints of full formulas along with their selected ingredients are utilized to both analyze the thickening mechanism and build formulas with desired rheological attributes for skin, hair and home care formulations. Lissajous plots help to delineate the effects of key formulation variables, such as the intrinsic texture of base thickener systems and the influence of auxiliary ingredients of formulation on this texture. This practical method serves as an effective toolkit to facilitate the product development process.

predicting skin sensory properties of cosmetics by instruments – from "pick-up", "rub-out" to "after-feel"

Dr. Xin Qu
Global R&D Lab Manager
Ashland, Shanghai – China

Sensory elegance of cosmetic products always plays an important role in its acceptance and preference by consumers. However, considerable amount of the time and cost were needed to establish and maintain a professional sensory panel. The feasibility of using rheometer and texture analyzer were investigated to predict sensory attributes of skin care emulsions from "pick-up", "rub-out" to "after-feel". Based on the collected data, a series of precise predictive equations were presented, and the predictive models were developed using simple linear regression and Stepwise multilinear regression by the best Pearson's correlation coefficients and minimum value of AICc. The results showed that the texture analyzer can predict the sensory attributes associated with the feeling of force, such as Firmness, Spreadability, and Peak after pick-up by single parameter, and the rheometer can obtain many different parameters to predict attributes, such as Hydration feel, Greasiness, Ease of pick-up and above-mentioned attributes by multiple parameters. All the values of R2 for these predictive models were above 0.80. A few new methods were designed to measure three sensory attributes of ease of pick up, peaking and tackiness, while the modified methods were developed to measure spreadability and firmness. The methods in this research are very effective and easy to operate and can support alternatives to traditional sensory profiles obtained with trained panels.

hacking your competitors' products with rheology and tribology profiling

Neil Cunningham
Founder and CEO
Centre for Industrial Rheology, Warnford – UK

In this talk Neil will outline the tools he and his team employ to generate physical "landscapes" and "maps" that enable clients to benchmark competitor products and quantify similarity of development formulations to products of known sensory properties. The talk will cover rheology and tribology testing methods and some of the approaches employed for results analysis and visualisation. The talk will be relevant to formulators of cosmetics, personal care products, topical pharmaceuticals, foods and beverages.

hair conditioner - it is all about rheology

Dr. Coralie Alonso
R&D Manager, Hair Care
Ashland, Zwijndrecht - Netherlands

Rinse off hair conditioners are complex liquids which structure is designed to give the consumer both an enjoyable sensorial experience and good combability. A hair conditioner is instantly recognizable by its texture and spreading ability as well as appearance, all governed by rheological properties. The palette of ingredients is quite limited to create the lamellar structure necessary for technical performance and texture but as consumers demand for light conditioning is increasing globally, new formulations approaches are required.
Ashland polymers can enable a redesign of hair conditioner formulations to match consumer expectations. Two examples are described in this presentation. Natrosol™ Plus 330CS allows for low solid fraction formulation that hold the lamellar structure, the right high viscosity at low shear and the fast shear shinning behavior expected for fast spreading and optimal performance. A more disruptive example shows how rinse off conditioners can be reinvented, relying on polymers for building the right rheological profile and delivering performance without lamellar gel phase.

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rheological fingerprinting of skin care formulations: insights into sensorial behavior

Dr. Roger McMullen, Principal Scientist
Dr. Hani Fares, Senior Director, R&D Care Specialties
Ashland, Bridgewater, NJ -USA

The use of rheology in characterizing semi-solid formulations has been investigated extensively. In this presentation, a new technique, Large Amplitude Oscillatory Shear (LAOS), will be presented. The technique delivers a means of dynamically probing the deformation of the micro-structure of a semi-solid preparation as it transitions from viscoelastic material to a fluid. LAOS offers many advantages compared to traditional rheological measurements, specifically Small Amplitude Oscillatory Shear (SAOS).
Data from the LAOS experiments is presented in the form of Bowditch-Lissajous curves for semi-solid preparations. In this study, four formulations representing different types of skin care chassis will be evaluated with this method. These formulations consist of: a traditional gel-cream stabilized with a polymeric matrix; a traditional O/W emulsion stabilized with a polymeric system and a mixture of emulsifiers; an O/W emulsion stabilized with a lamellar gel system; and a lipstick formulation stabilized with a wax matrix. The plots provide formulators with insight into the sensorial behavior of the tested formulation and how certain ingredients may affect the rheology more than others. The technique is very useful to formulators who want to make changes to a certain formulation without changing the overall characteristic of the product texture.

sensory drivers of consumer liking

Prof. Jean-Xavier Guinard
Dept. of Food Science
University of California, Davis , CA – USA

In our investigation of consumer behavior as it relates to foods, beverages and other consumer products, we use a consumer research model that considers the effects of product variables, consumer variables and context variables on purchase, choice and consumption behaviors. When we research how sensory properties factor in this model, we find that flavor almost always is the primary driver of consumer liking for foods and beverages, even though texture and mouthfeel do play a role as well. In this presentation, we will explore how sensory sensitivities (as determined by genetics) might affect our choices and experience and we will review whether preferences (likes and dislikes) for chemical (taste, smell, chemesthesis) and physical (touch, kinesthesia) stimuli are mostly innate or learned, and how they might vary over the lifespan. We will then show how preference mapping – an approach that uncovers market segmentation, identifies drivers of liking and fine-tunes product positioning is a proven product optimization tool, and how Empathic Design/ Design Thinking are best suited for breakthrough innovation. Finally, we will offer a new hedonic testing methodology and a new framework for researching and understanding the consumer experience.

biographies

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Dr. Osama M. Musa

Senior Vice President and Chief Technology Officer
Ashland, Bridgewater, NJ – USA

Dr. Osama M. Musa is currently Senior Vice President and Chief Technology Officer for Ashland Global Holdings. (NYSE: ASH). He leads Ashland's Global Research and Development focusing on consumer and industrial markets including pharmaceutical, personal care, beverage, nutrition, agricultural, coatings, adhesives, and energy applications. Dr. Musa has overall responsibility for Ashland's global technology including Applied Research, Measurement Science, Biofunctionals, Acrylates & Microencapsulation, Preservatives & Microbial Technology, as well as the R&D Stage-Gate development process. He also leads the R&D Council and Multifunctional Innovation Engagement Team which are charged with managing and enhancing new product development processes. In addition to these technical roles, he has the commercial and technical responsibility for Ashland's Advanced Materials business.
Dr. Musa is a strategic senior executive with broad experience in the specialty chemicals business sector. He utilizes a wide-ranging network, cooperating with partners both in the industry and in academia. Dr. Musa joined Ashland in 2011 following the company's acquisition of International Specialty Products (ISP) Incorporated. Previously, he held technical and leadership positions with the National Starch and Chemical Company.

As a passionate leader, Dr. Musa is committed to addressing customer needs through the application of innovative chemistry. From Ashland's Open Innovation platform, he cultivates student scholarship through numerous collaborations with universities, providing encouragement and motivational mentoring to the next generation of young, promising scientists. He serves as a member of the Advisory Board at Manhattan College's Department of Electrical and Computer Engineering as well as a member of the Board of Trustees at Chemists' Club of NYC. In addition, he sits on the Advisory Board of the International Journal of Humanitarian Technology (IJHT).

Prof. Vivek Sharma

Dept. of Chemical Engineering
University of Illinois, Chicago, IL – USA

Dr. Vivek Sharma is an Assistant Professor of Chemical Engineering at the University of Illinois Chicago. Before joining UIC in November 2012, he worked as a post-doctoral research associate in Mechanical Engineering at Massachusetts Institute of Technology.
He received his Ph. D. (Polymers/MSE, 2008) and M. S. (Chemical Engineering, 2006) from Georgia Tech., an M. S. (Polymer Science, 2003) from the University of Akron, and a bachelor's degree from IIT Delhi. Dr. Sharma's research interests broadly lie in optics, dynamics, elasticity, and self-assembly (ODES) of complex fluids and soft materials. At UIC, Dr. Sharma's Soft Matter ODES-lab combines experiments and theory to pursue the understanding of, and control over interfacial and nonlinear flows, focused on the interplay of (a) viscoelasticity and capillarity for printing applications and extensional rheometry, and (b) interfacial thermodynamics and hydrodynamics in fizzics (the science of bubbles, drops, thin films, jets, fibers, emulsions and foams). Dr. Sharma was selected as the Distinguished Young Rheologist by TA Instruments in 2015, and won the 2017 College of Engineering Teaching Award at UIC.

Dr. Seher Ozkan

Dept. of Materials Science
Ashland, Bridgewater, NJ – USA

Dr. Seher Ozkan has B.S. and Ms. Sci. degrees in Mechanical Engineering from Istanbul Technical University (ITU) in Istanbul, Turkey and Ms. Eng. and Ph.D. degrees in Chemical Engineering from Stevens Institute of Technology (SIT), Hoboken, NJ. After she began her career as a mechanical engineer in the plastic industry in Istanbul, Ms. Ozkan moved to the U.S. where she continued her graduate studies in polymer rheology/processing and tissue engineering under the supervision of Dr. D.M. Kalyon and Dr. X. Yu in SIT. She was awarded a Merck Research Laboratories Fellowship, 2007-2008, in Chemistry, Pharmaceutical Science, Material Science, and Engineering. She completed the degree of Doctor of Philosophy in Chemical Engineering in 2008 and won the Exxon Mobile award for outstanding achievement in pursuing the PhD degree in Chemical Engineering. In 2009, she joined the Materials Science Department at International Specialty Products (ISP). Currently, she works as a Senior Scientist for Ashland Specialty Chemicals (formerly ISP), where her major research areas are correlation of rheological and mechanical properties of polymeric solutions and formulations to in vitro performance test results (sensory correlation, bioadhesion, etc.). Her work is published in Biomaterials, Journal of Biomedical Materials Research, International Journal of Cosmetic Science, Journal of Applied Polymer Science and in meeting proceedings such as AAPS, MRS, SOR, ACS and NYSCC.

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Dr. Xin Qu

Global R&D Lab Manager
Ashland, Shanghai – China

Dr. Qu had his B.S. from University of Science and Technology of China in 1994, and Ph.D. from Royal Institute of Technology, Stockholm, Sweden in 1999, major in Polymer Technology. After graduation, he worked as Postdoc in Columbia University, New York for 2 years, and then worked in Hydromer Inc., New Jersey as Senior Research Scientist since 2002. In 2006, Dr. Qu came back to Shanghai, and joined ISP Corp. (merged with Ashland Inc. in 2010) as Global R&D lab manager – Personal Care in Shanghai Technical Center. Dr. Qu published more than 70 articles in both international and Chinese journals, and US/Chinese patents in the areas of hair care, skin care and preservatives etc.

Neil Cunningham

Founder and CEO
Centre for Industrial Rheology, Warnford - UK

Since starting as an independent consultant in the field of rheology measurement in 1998 Neil Cunningham has delivered practical training and advice in the principles and practical application of rheological profiling to thousands of researchers, formulators and quality controllers in the world's leading companies in industries such as cosmetics, pharmaceuticals, foods and industrial coatings. In 2012 Neil founded The Centre for Industrial Rheology and now leads a team of eight (and growing), delivering sample analysis and research, training and advice in a range of physical testing methods for suspensions, emulsions, gels and other liquids and semi-solids.

Dr. Coralie Alonso

R&D Manager, Hair Care
Ashland, Zwijndrecht - Netherlands

Coralie is a principal scientist for Hair Care at Ashland Industries.
She leads the R&D program for Hair Conditioning, building a strong product pipeline aligned to global trends to address customers needs.
Coralie is a Physics major, she obtained her PhD in France, at the Université Joseph Fourier in Grenoble. She worked for 5 years as a PostDoc scientist, first at the Weizmann Institute in Israel and then at the University of California in Santa Barbara. Her work his published in more ten 20 peer review articles.
She joined Unilever R&D, in the UK in 2004 where over 13 years, she held various leadership roles across Home Care and Personal Care, before joining Ashland in April 2018. Coralie has extensive experience in interfacial phenomena, surface and deposition science.

Dr. Roger McMullen

Principal Scientist
Ashland, Bridgewater, NJ - USA

Roger is a Principal Scientist in the Materials Science Department at Ashland Specialty Ingredients. He received a B.S. in Chemistry from Saint Vincent College and completed a Ph.D. in Biophysical Chemistry at Seton Hall University. Roger has over 20 years of experience in the Personal Care industry, having worked in many facets of product development and claims substantiation leading to the commercial launch of new technologies. His work and professional activities reflect his dedication and service to the personal care industry with specialties in imaging and optical techniques used in conjunction with image analysis to quantify various properties of hair and skin, spectrofluorescence of hair and skin, mechanical measurements of personal care substrates, and various aspects related to the use of antioxidants and other active ingredients in skin care. Roger actively speaks at international conferences and is the primary author of over 25 peer-reviewed book chapters and journal articles. He is also the author of the book, Antioxidants and the Skin, 2nd ed., published in 2018. For the past 10 years, Roger has been an Adjunct Professor at Fairleigh Dickinson University, where he teaches Biochemistry to students in the Cosmetic Science Master's program. Prior to pursuing a career in science, Roger served in the U.S. Navy onboard the vessel, USS YORKTOWN (CG 48).

Dr. Hani Fares

Senior Director, R&D Care Specialties
Ashland, Bridgewater, NJ - USA

Dr. Fares started his career in personal care studying the effect of solvents on sunscreen chemicals. His interest in skin drug delivery especially from polymeric matrices grew during his graduate work at Rutgers, where he completed his Ph. D. in Pharmaceutics.
Dr. Fares worked at Block Drug and GlaxoSmithKline where he held positions in research and development in the areas of skincare and oral care. After that, he joined L'Oreal where he held several positions of increasing responsibility leading to AVP of skincare. He is currently the Senior Director of skincare and oral care at Ashland Specialty Ingredients. Dr. Fares is the author of many publications, and patents and made many presentations in national and international meetings in the areas of suncare, skincare, and oral care.

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Prof. Jean-Xavier Guinard

Dept. of Food Science
University of California, Davis, CA - USA

Jean-Xavier Guinard is a Professor of Sensory Science at the University of California, Davis. Trained as a food and agricultural engineer in France, he holds a PhD in microbiology and master's degrees in sensory physiology and food science/enology.
Jean-Xavier's research focuses on sensory strategies for dietary change (including The Flexitarian Flip™) and optimizing the sensory quality and consumer acceptance of foods, beverages and other consumer products. He is co-director of the UC Davis Coffee Center. He teaches undergraduate, graduate and lifelong learning courses in sensory, consumer and food science, and consults for a number of food and beverage companies and consumer agencies worldwide. Over the past 12 years, Jean-Xavier has served in various administrative leadership roles for international education and the Robert Mondavi Institute for Wine and Food Science at the University of California.

Linda C. Foltis

Vice President, Hair and Home Care
Ashland, Bridgewater, NJ - USA

Linda Foltis leads global R&D for personal and home care applications at Ashland Specialty Ingredients. She leads a talented team of scientific solvers located in laboratories in the Americas, Europe and Asia with a focus on the development of new ingredients, new applications and customer collaboration across personal care, home care, beverage and agriculture. Previous experience includes ISP, L'Oréal USA, Playtex (now Edgewell), and Unilever.
Foltis holds a MS in Chemistry from Seton Hall University, NJ, USA, with a minor in business. She is the author and co-author of several technical papers published in both scientific and cosmetic trade journals. She is a member of Society of Cosmetic Chemists, Cosmetic Executive Women, and Personal Care Product Council Scientific & Regulatory Forum. She served as a board member of Textile Research Institute (2008 -2014).

Mark Davies

Research Scientist
Ashland, Bridgewater, NJ - USA

Mark Davies is responsible for in vivo measurement of deposition, penetration, and efficacy of skin care products and cosmetics at Ashland Specialty Ingredients. Previous experience also includes work at Unilever and L'Oréal. Mark received his BA in Chemistry from New York University. His PhD thesis was on Raman scattering by chiral molecules, directed by Professor Max Diem at the City University of New York. Postdoctoral work includes acyl chain conformational disorder in lipid bilayers with Professor Richard Mendelsohn at Rutgers University leading to his continued work as a research assistant professor in the biochemistry department at Georgetown University School of Medicine.

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