Reformulating to Waterborne Coatings Short Course	
Logistics:	February 5 - 6th, 2024 Astor Crowne Plaza New Orleans, LA
Program Coordinated by:	Robson F. Storey, Ph. D. School of Polymer Science and Engineering The University of Southern Mississippi
Held in conjunction with:	The 51st Annual International Waterborne, High-solids and Powder Coatings Symposium

Reformulating to Waterborne Coatings Short Course

Logistics:	February 15 - 6, 2024 8:00 am – 5:00 pm Astor Crowne Plaza, New Orleans, LA
Program Coordinated by:	Robson F. Storey, Ph. D. School of Polymer Science and Engineering The University of Southern Mississippi
Course Purpose:	To provide chemists in the coatings industry an understanding of the principles involved in reformulating systems to a waterborne system. The course is designed for coating chemists and formulators and for persons interested in new applications for waterborne coatings.
Course Description:	Reformulating to Waterborne Coatings is an intensive, two-day course providing an introduction to the technology of waterborne coatings with an emphasis on the challenges encountered in converting existing solvent-borne coating systems to water. It consists of a series of lectures organized around various popular coating types including acrylic latex, polyester/alkyd, two-component polyurethane, polyurethane dispersion, epoxy, and silicone. Additional topics include the use of additives, pigments and pigment dispersion, and application methods for waterborne coatings.
Who Should Attend:	The course is designed for coating chemists and formulators and for persons interested in new applications for waterborne coatings.

Time	Monday, February 5th, 2024	
7:55 am	Dr. Robson F. Storey, University of Southern Mississippi	Opening Remarks and Course Overview
8:00 am		Fundamentals of Polymer Design for Waterborne Coatings
9:15 am	Dr. Partha Majumdar, Dow Chemical Company	Formulating Waterborne Acrylic Polymers for Industrial Coatings
9:30 am	Coffee Break	
9:45 am	Dr. Partha Majumdar	Formulating Waterborne Acrylic Polymers for Industrial Coatings (cont.)
10:45 am	Todd Williams, Covestro	The Chemistry of Waterborne Polyurethane Dispersions
12:00 pm	Lunch Break	
1:00 pm	Jim Reader, Evonik	Surfactants, Defoamers and Dispersants in Waterborne Coatings
2:15 pm	Keith Moody, Retired, Eastman, Consultant	Optimum Selection of Solvents in Waterborne Coating: Minimizing VOC and Maximizing Performance
2:45 pm	Coffee Break	
3:00 pm	Keith Moody	Optimum Selection of Solvents in Waterborne Coating: Minimizing VOC and Maximizing Performance
3:45 pm	Chun Ren, Axalta	Formulation of Waterborne Pigment Dispersions
5:00 pm	**Session Ends for Day 1**	

Time	Tuesday, February 6th, 2024	
8:00 am	Mike Jeffries, Covestro	High Performance Waterborne Two-Component Polyurethanes
9:15 am	Shiying Zheng, Evonik	Formulating Two-Package, Ambient-Cure Waterborne Epoxy Coatings
9:30 am	Coffee Break	
9:45 am	Shiying Zheng, Evonik	Formulating Two-Package, Ambient-Cure Waterborne Epoxy Coatings (cont.)
10:45 am	Sam Morell, SamMorell.com	Rheology of Waterborne Coatings
12:00 pm	Lunch Break	
1:00 pm	Romesh Kumar, Retired, Heubach	Pigment Selection for Waterborne Architectural Coatings
2:15 pm	Jeff Arendt, Arkema Coating Resins	Formulation of Waterborne Polyester/Alkyd Coatings
2:45 pm	Coffee Break	
3:00 pm	Jeff Arendt, Arkema Coating Resins	Formulation of Waterborne Polyester/Alkyd Coatings
3:45 pm	Don Liles, Consultant	The Role of Silicones in Formulating Water-Based Coatings
5:00 pm	**Conclusion of the 2024 Reformulating to Waterborne Coatings Short Course**	

Abstracts – Monday, February 5, 2024

Welcome & Course Overview
Fundamentals of Polymer Design for Waterborne Coatings

This introductory lecture discusses the general features of polymers used in waterborne coatings, and how these polymers differ from polymers used in traditional solventborne coatings. Various waterborne polymers are classified with regard to their manner of preparation, and fundamental concepts of polymer preparation are introduced. Dispersion of pre-formed polymers into water is discussed. Finally, the basic chemistry of waterborne polymers is discussed for each of the major waterborne coating binder types: alkyds, polyurethane, acrylic, epoxy, and amino resins.

Formulating Waterborne Acrylic Polymers for Industrial Coatings

This lecture introduces acrylic polymer technology and its use in paints and coatings, with an emphasis on waterborne latex polymers. The composition and morphology of acrylic latex polymers is discussed, focusing on how they affect performance properties of both the wet coating and the final dry film. Latex film formation will be described, including the impact of coalescent selection and drying conditions (temperature, humidity) on the process, and ultimately discussing how film formation relates to final film properties. Rheology is an important aspect of formulating, and the common types of thickeners used with latex coatings and their mechanisms will be covered. Crosslinking is useful to improve certain film properties, and various chemistries for crosslinking acrylic coatings and their effect on formulation and performance will be described.

Pigment Selection for Waterborne Architectural Coatings

Competition and environmental regulations require the architectural coatings manufacturers to develop innovative formulations to improve traditional colorant systems. This includes improved hiding, reduced VOC (almost zero), increased durability, and optimum cost of use. Single coat hiding requires specific organic pigments in blends with heavy metal free highly chromatic inorganic pigments. Very low VOC free colorants require unique composition to achieve properties similar to those of regular types. Highly durable colorants require pigments that do not show any significant color change for at least after five years exposure in Florida, which are also resistant to the effect of lime burn with minimum or no efflorescence. Powder and coil coatings are also commonly used for architectural applications. The pigments for these systems require relatively high heat stability and weather fastens as such coatings are guaranteed for long term performance, i.e. minimum color change over 10-20 years. Only a few organic and inorganic pigments meet the requirements necessary for this part of architectural coatings.

Surfactants, Defoamers and Dispersants in Waterborne Coatings

This lecture discussion the use of surfactants and defoamers in waterborne coatings. The objective is to provide an understanding of the factors that influence surfactant and defoamer selection and performance in coatings. The course starts with a basic introduction to surface chemistry. It continues with a discussion of what surfactants and defoamers are and how they work. The focus is on explaining ways to select surfactants and defoamers to avoid defects and obtain optimal coating performance.

Optimum Selection of Solvents in Waterborne Coating: Minimizing VOC and Maximizing Performance

Although formulators of waterborne coatings often minimize the use of solvents, most formulations do contain solvents that assist in improving the coating performance and appearance. In this lecture we will discuss how solvents are critical in formulating waterborne coatings where the binder is usually not water soluble but forms an aqueous dispersion. Solvents help in applications where water alone won't wet the surface of the substrate because of high surface tension. We will discuss how solvents are used in these heterogeneous systems for coalescence and plasticization, for coupling of water insoluble ingredients in the formulation, and for assisting in flow and leveling. We will show how solvents can decrease dry time in waterborne coatings. We will discuss how temperature often dictates how solvents interact with water as well as the binder. We will discuss some basic properties like minimum film forming temperature, lower critical solution temperature, and critical relative humidity, all important to understand when selecting the correct solvents. Participants should come away with a better understanding of how critical solvents are in waterborne coatings.

Formulation of Waterborne Pigment Dispersions

Coming

Abstracts – Tuesday, February 6th, 2024

High Performance Waterborne Two-Component Polyurethanes

This talk with discuss the chemistry of both components in a two-component PUD. It will review water dispersible polyisocyanate crosslinkers and isocyanate reactive waterborne polymers. In addition methods of formulating these products will be reviewed. Applications of these materials will be discussed.

Formulating Two-Package, Ambient-Cure Waterborne Epoxy Coatings

This talk will introduce the concept and applications of waterborne epoxy systems. It will describe the chemistry, design principles, and types of epoxy resin and amine curing agents used in such systems. The presentation will cover the components of the waterborne epoxy systems, as well as system characteristics. In addition, coating application variables, formulation strategies and guidelines, and example formulations will be provided in this talk.

Rheology of Waterborne Coatings

This presentation on rheology reviews the basic principles of rheology including its definition and its influencers - chemical structure, morphology, and environmental conditions. The impact by various deformation forces including compression, tension, torque, and, particularly, shear will be examined to demonstrate the resulting flow profiles of viscosity as a function of shear and time. A review of the chemistry of current rheological agents will help clarify their efficacy in various formulation and system types including waterborne, solventborne, aliphatic, aromatic, and polar.

The Chemistry of Waterborne Polyurethane Dispersions

Coming

Formulation of Waterborne Polyester/Alkyd Coatings

The value proposition of alkyds resins in coating markets remains strong. With sustainability initiatives affecting the industry at all levels there is a need to convert higher VOC formulations to more sustainable low VOC formulations. This lecture will review the chemistry and history of alkyds/polyester in coatings. We will then discuss the evolution of low VOC alkyd technology. Using modern techniques high-performing waterborne alkyd coatings, with VOC ranging towards near zero VOC are being produced on a commercial scale. This talk will review options for reformulating to these more sustainable lower VOC solutions. Alkyd emulsions, alkyd dispersions, water-dilutable alkyds and water-reducible alkyds will be reviewed. Formulation techniques will be discussed along with comparisons to other common water-based resin technologies. The attendee will walk away with a basic understanding of modern water-based alkyd resin technology along with an understanding of how to formulate waterborne alkyds coatings.

The Role of Silicones in Formulating Water-Based Coatings

Silicones represent a class of compounds that are based on the element silicon, and they exist in a variety of forms that include oils, fluids, high viscosity polymers, gums, elastomers, resins and silanes. Silicones are totally synthetic, and they have been commercially available for about the past 80 years. Due to their unusual surface properties and their ability to accommodate wide temperature extremes, silicones have become indispensable in the developed world as they are used in myriad applications, including coatings. Silicones' use in coatings began during the early stages of silicone commercial development and today they are used extensively in coatings to provide improved flow and leveling, slip properties and improved abrasion resistance, enhanced weatherability and thermal stability, release, defoaming, adhesion or to achieve a specific purpose. The use of silicones in water-based coatings falls into the following general categories: (1) silicone additives in which a small amount (<1%) of silicone is used; (2.) silicone polymers whereby silicones constitute from 30-50% of the coating binder; (3.) 100% silicone coatings in which the entire coating binder is silicone; and (4.) aqueous water repellents. This lecture will present a brief introduction to silicones by describing what they are and some of their properties. It will also cover silicones' function in water-based coatings and the benefits obtained from their use. Due to silicones' unusual surface properties, several types of surface defects in water-based coatings can arise from certain silicones. A short discussion will also be presented on surface defects and how silicones can both cause and alleviate some surface defects in water-based coatings.