Foundational Training in Polymer Coatings

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Introduction

MRIGlobal currently lacks depth in expertise with formulating polymeric coatings. Two current projects (QRC and Radiant Eagle) involve research with polymeric coatings, and we have scientists skilled with applying/testing those coatings. What we really lack is designing the additives/amounts for formulating new coatings based on what physical and chemical properties we hope to achieve.

This Maillie Award was meant to review the quality of two different courses: Polymer Coatings offered by Technology ED (online course) and Polymer Chemistry course offered by the ACS at Virginia Tech (in-person/hands-on). The hands-on course would of course be more beneficial than an online course, but it is possible that the online course would be sufficient.

Unfortunately, we all had to make sacrifices because of Covid-19. I did not attend the ACS course at Virginia Tech, and only completed the online course by Technology Ed.

The online course consisted of 12 modules culminating in a final exam.

Executive Summary

The online course included the following modules:

- Introduction to Polymeric Coating Formulations
- Coating Properties
- Raw Matericals
- Solvent-Borne Coatings
- High Solid Coatings
- Water-Borne Coatings
- Powder Coatings
- Radiation Cure Coatings
- Architectural Coatings
- Regulatory Considerations
- Next Generation Coatings

The information given by the course is very high-level. This course in general should be considered an introduction to polymer coatings as it imparts the base knowledge but nothing deeper than that. Unfortunately, this course does not help designing polymer formulations. The use for this course is to give the student the tools to know what to research in order to dive deeper into the subject.

References

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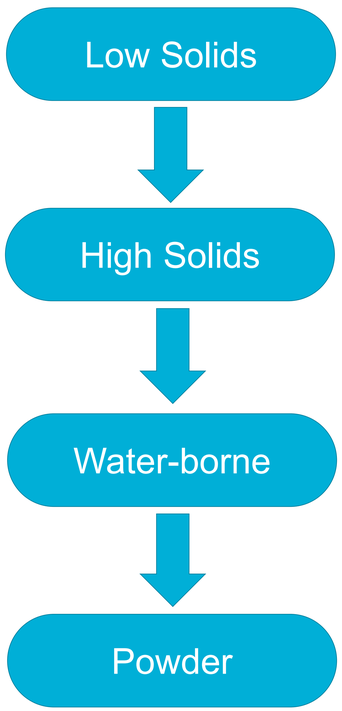
Progression of Formulations



Low Solids

Improvements
- Lower Toxicity
- Lower Fire Hazard
- More Coating Per Container
- Cheaper Exhausting Equipment
- Helps Self-Orientation for Some Materials (Metallics)

Disadvantages
- Higher Viscosity
- Limited Application Methods
- Better Surface Preparation Required
- Short Pot Life

High Solids

Improvements
- Very Low VOC Emissions
- Easier to Apply and Clean Up
- Lower Disposal Requirements
- Easier to Recover Overspray

Disadvantages
- Lower Chemical and Solvent Resistance
- Reduced Temperature Resistance
- Sensitive to Humidity
- Better Surface Preparation Required
- Lower Abrasive Resistance

Water-borne

Improvements
- No Waste Disposal Issues
- No Solvent Emissions
- Reduced Energy Costs
- Almost All Overspray can be Recovered
- Single Coats

Disadvantages
- Harder to Apply Thin Films
- Can Only Coat Metal Surfaces

Powder

Next Generation Coatings

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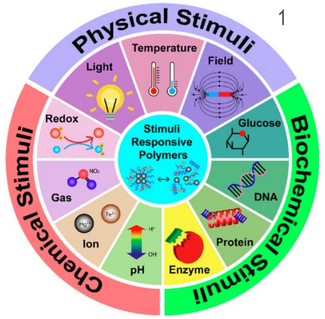

Smart Coatings

Physical Stimuli:
- Color changing Mugs
- Drug Delivery by AC Magnetic Field
- Polymer Brushes (Light Stimulated)

Chemical Stimuli:
- Corrosion Detecting (pH change)
- Gas Leak Detection (Odor Release)

Biochemical Stimuli:
- Drug Delivery
- Bandages
- Cell Engineering

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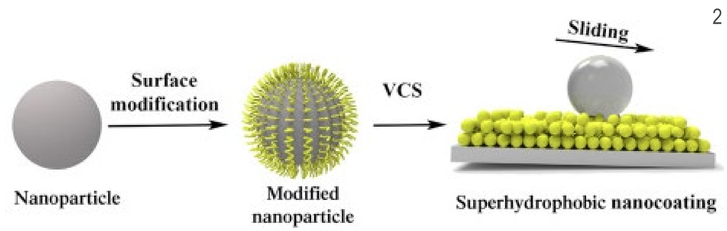

Nano Coatings

Advantages:
- Better Surface Appearance
- Chemical Resistance
- Decrease in Permeability
- Optical Clarity
- Better Conductivity
- Good Adherence on Variety of Surfaces

Disadvantages:
- Dispersion/Stability
- Pigments May Lose Color
- Hardening Ultrafine Powders
- New Environmental Problems

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