Nov 2013

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Polymers used in paints

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Bui Van Minh

CONTENTS

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- Paint definition
- Application
- History of paints science and technology
- Paint classifications
- Film forming mechanisms
- Basic paint ingredients
- Ingredients made from polymers
- Key paint players in Vietnam market
- Video clip – plant introduction
- Q&A

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Definition: "Paint is any **pigmented liquid, liquefiable, or mastic composition** designed for application to a substrate in **a thin film** which is converted to an **opaque or transparent solid film** after application.

Used for protection, decoration or identification - or to serve some functional purpose such as filling or concealing surface irregularities, or the modification of light and heat radiation characteristics, etc."

-Paint/Coatings Dictionary

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WHAT ARE PAINTS USED FOR?

Decoration

Recognition

Camouflage

Protection

Notice

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HISTORY OF PAINTS SCIENCE AND TECHNOLOGY

When the paints were used?

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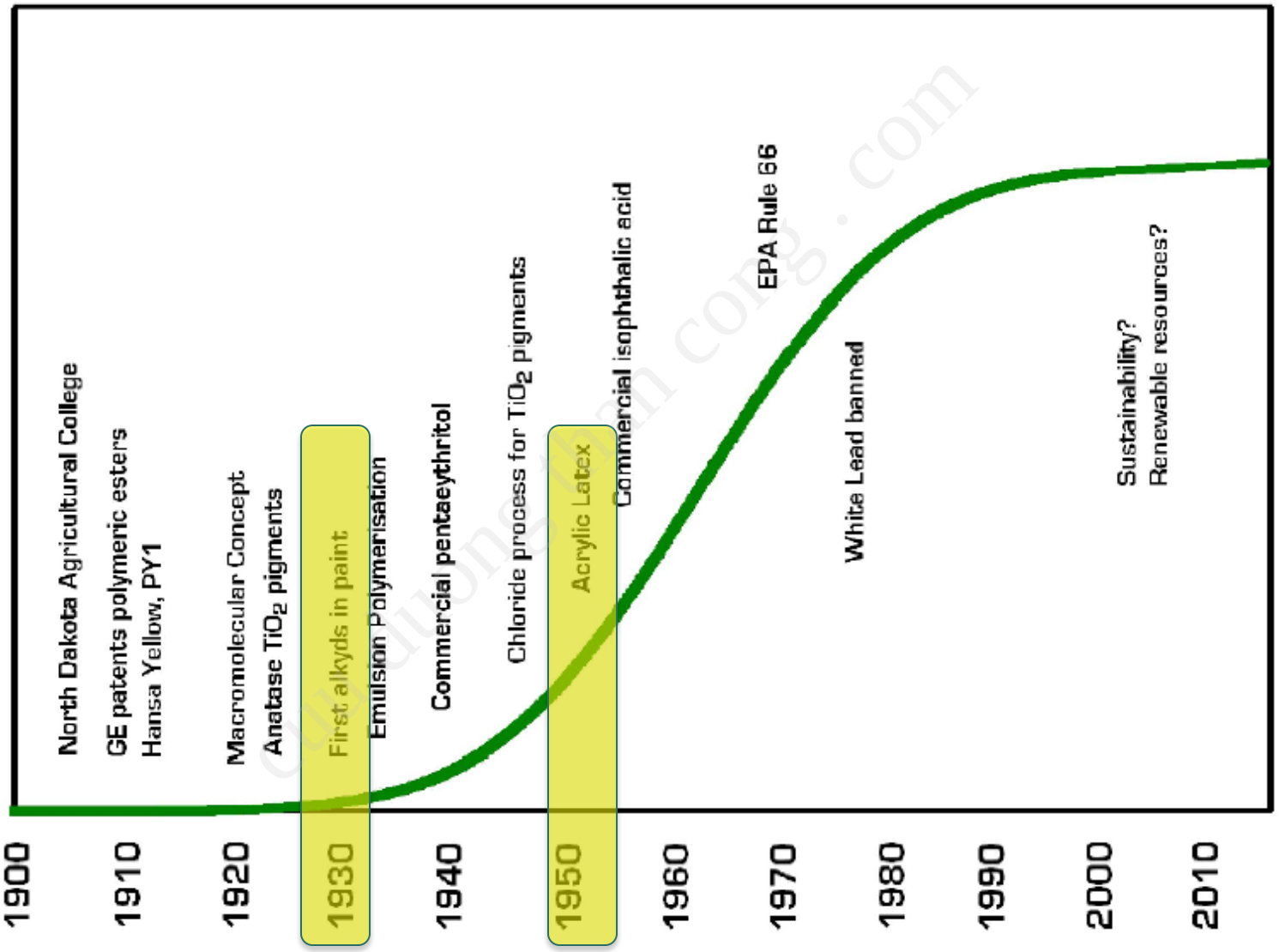

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SOURCE: http://www.ndsu.edu/fileadmin/croll/HistoryofPaintSGC.pdf

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PAINT CLASSIFICATIONS

CONNELL BROS.
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TECHNOLOGIES

- **WATER BORNE**
- **SOLVENT BORNE**
- HIGH SOLIDS
  - WATER
  - SOLVENT
- TWO COMPONENTS
- HOT MELTS
- EXTRUDED
- RADIATION
  - UV
  - E-BEAM
- POWDER
  - REGULAR
  - RADIATION
- ELECTRODEP
- CO2 (UNICARB)

POLYMERS

- **ALKYDS**
- **EPOXY**
- **POLYURETHANES**
- **ACRYLICS**
- POLYESTER
- POLYOLEFINS AND WAXES
- VINYL ACETATE
- CELLULOSICS
- ELASTOMERS
- AMINO
- VINYL CHLORIDE
- PVDC
- SILICONES AND SILANES
- FLUOROCARBONS
- POLYAMIDES
- FATTY OILS AND ACIDS
- OTHERS

APPLICATIONS

- **WALL COATINGS**
- **GENERAL METAL**
- **COIL**
- **FURNITURE – WOOD, METAL**
- APPLIANCES
- AUTOMOTIVE
- METAL CONTAINERS
- MACHINERY AND EQUIPMENT
- LAND TRANSPORTATION
- PIPE
- MARINE
- AIRCRAFT
- PLASTICS

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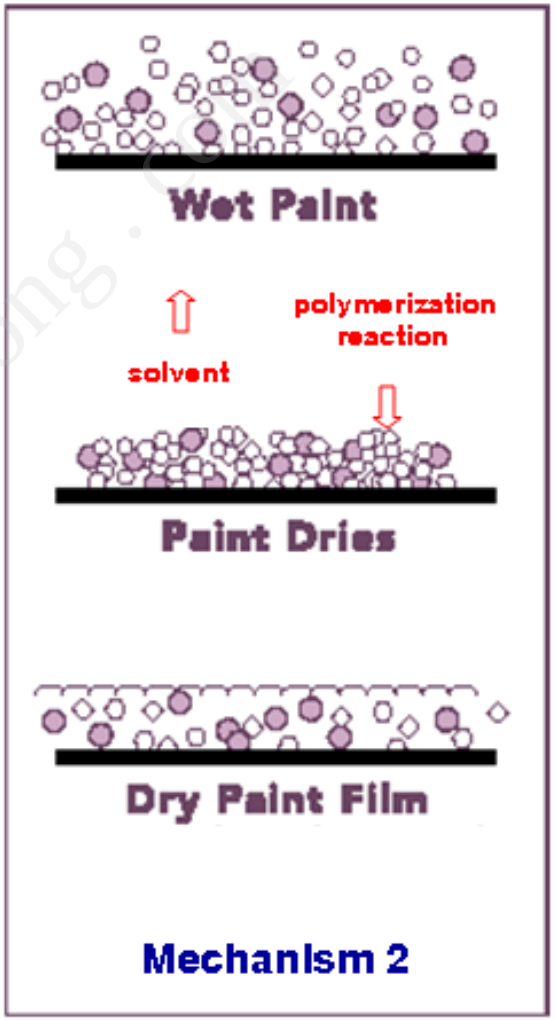
FILM FORMING MECHANISMS



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BASIC PAINT INGREDIENTS

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- Liquid (solvent) - Acts as a carrier for the pigments and binder
- Additives - Enhances certain properties such as brushing ease and mildew resistance
- Binder - Holds pigment particles together and provides adhesion
- Pigments - Provide color, hiding and other functions

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ARCHITECTURAL COAITNGS – WATERBORNE

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Paint ingredients

1. Binders
2. Dispersants
3. Surfactants
4. Defoamers
5. Pigments
6. Extenders
7. Thickeners
8. Opac Polymer
9. Solvents
10. Biocides
11. Others

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ARCHITECTURAL COAITNGS - WATERBORNE

BINDERS

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Paint ingredients

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LATEX POLYMER TYPES	MONOMERS	APPLICATIONS
1. Vinyl Acetate	– VA Homopolymer	- Tape Joint
2. Vinyl Acrylic	– VA & BA	- 1st Line Interior
		- 2nd Line Exterior
3. Vinyl Acetate/VeoVa	– VA & VeoVa	- Masonry Coatings
4. Vinyl Acrylic/VeoVa	– VA & Ethylene	- Interior & Exterior
5. All-Acrylic	– BA & MMA	- 1st Line Exterior
6. Styrene Acrylic	– BA, MMA, & STY	- Interior & Exterior
7. Acrylic/ Veova	– BA, MMA & VeoVa	- Specialty Coatings

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COMPARISON OF DIFFIRENT EMULSION CHEMISTRIES

Binder Type	100% Acrylic	Acrylic Styrene	VA/Veova	Vinyl Acrylic	PVAc
UV Resistance	5	3	3	2	1
Alkaline Resistance	5	5	3	2	1
Water Resistance	4	5	3	2	1
Efflorescence	5	5	3	2	1
DPUR	5	4	3	1	2
Color Stability	5	2	3	3	1
Cost	1	3	2	4	5

5 = Best, 1= Poorest

Table above is just general comparison – actual performances depending on monomers / functional groups / surfactants and others ingredients used to produce binders

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WHICH INGREDIENTS CAN BE MADE FROM POLYMERS IN PAINT FORMULATION?

Paint ingredients

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3. Surfactants
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5. Pigments
6. Extenders
7. Thickeners
8. Opac Polymer
9. Solvents
10. Biocides
11. Others

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Wetting and Stabilizing system

Paint ingredients

1. Binders
2. **Dispersants**
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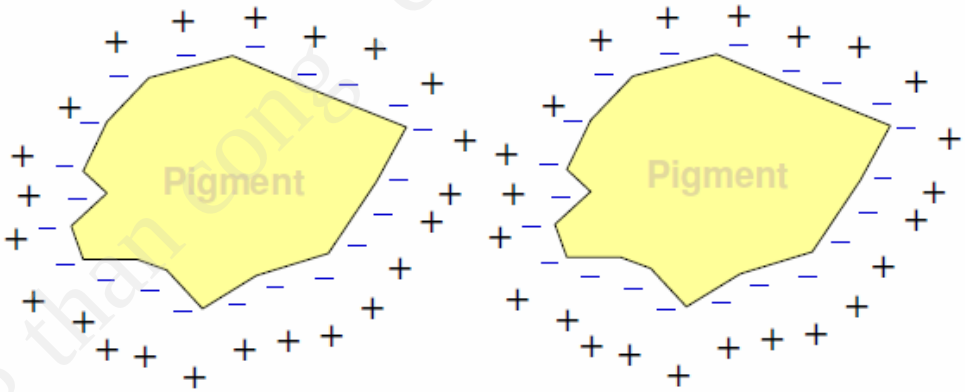
Electrostatic Repulsion



Steric Exclusion

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Paint ingredients

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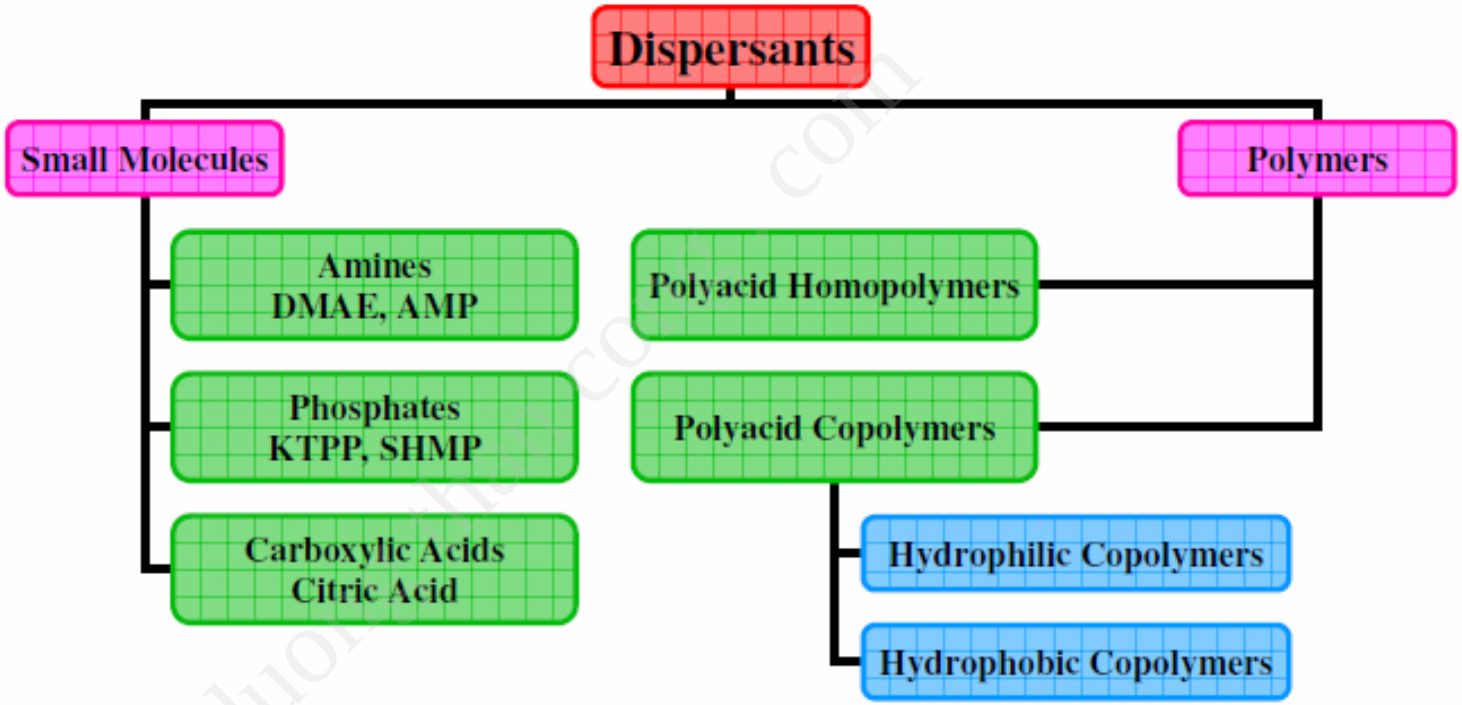
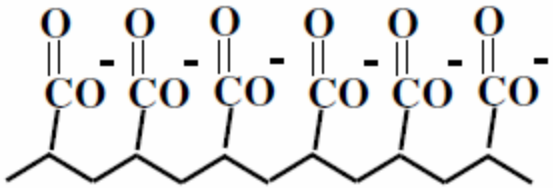
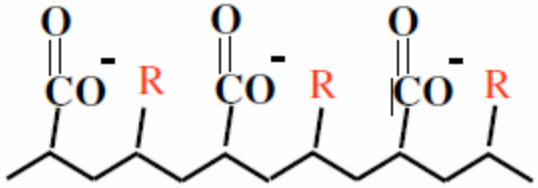


Polyacid Homopolymer



Polyacid Copolymer



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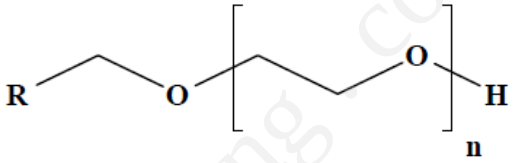
Fatty Alcohol Ethoxylate - Aliphatic

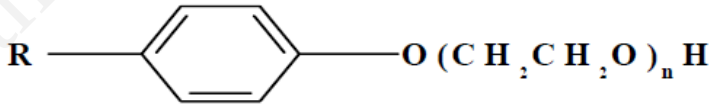
– Alfonic, Brij, Rhodasurf, Neodol, Surfonic, Triton . . . .



R = C_8, C_{12} . . . .

Alkylphenol Ethoxylate - Aromatic

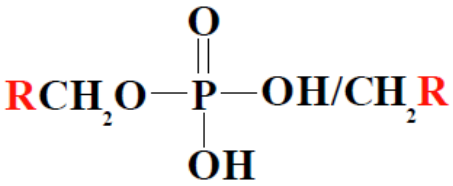
– Armul, DeSonic, Igepal, Surfonic, Triton . . . . . .



R = octyl-, nonyl- . . . . . .
n = ethoxylation length

Phosphate Esters:

- Dextrol, Strodex . . . . . .



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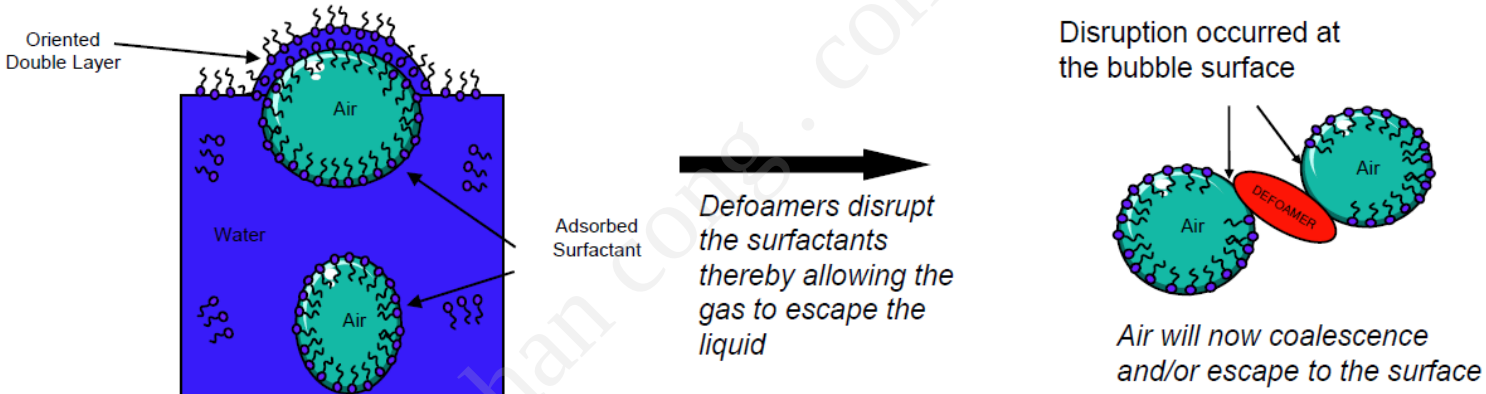
Working mechanism



Common defoamers

1. Mineral oil based
2. Silicone oil based
3. Hyper-branched polymer molecule

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Titan dioxides

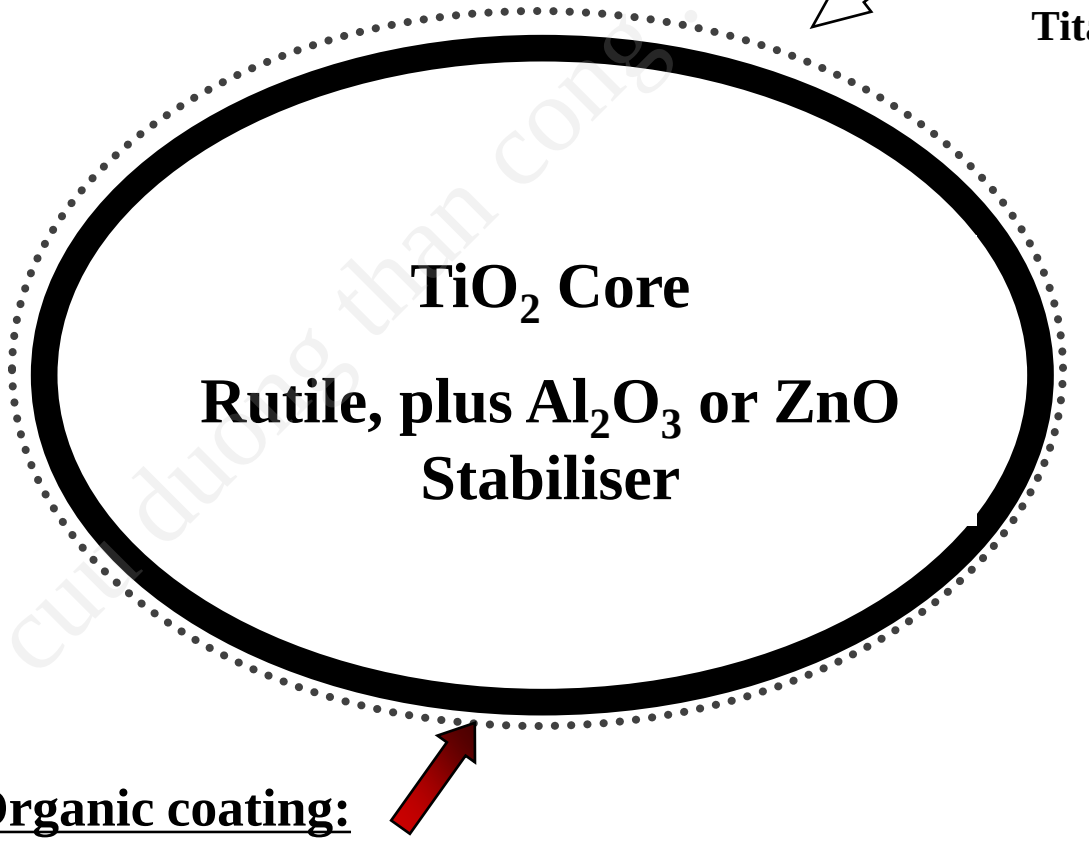
White Inorganic oxides:

Alumina

Silica

Zirconia

Titanium



Organic coating:

Polyols, Siloxanes, Amines

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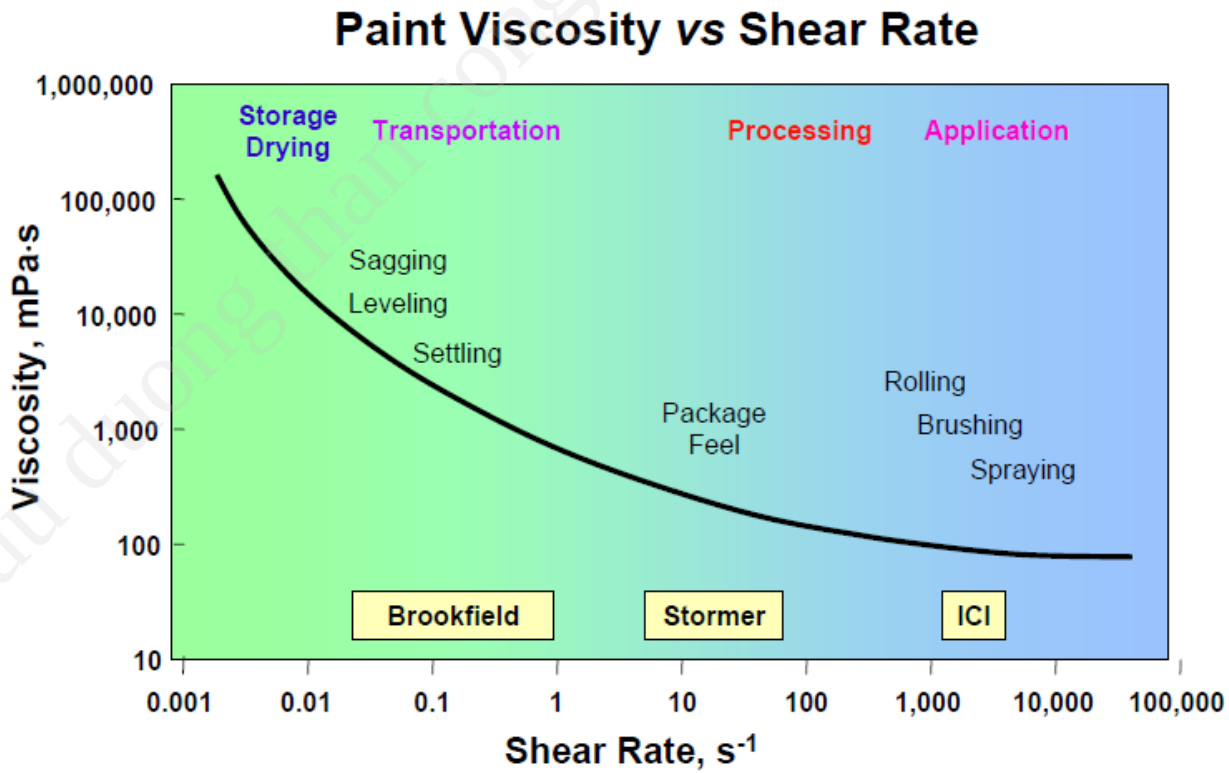
Functions

1. Stabilize system
2. Improve application properties



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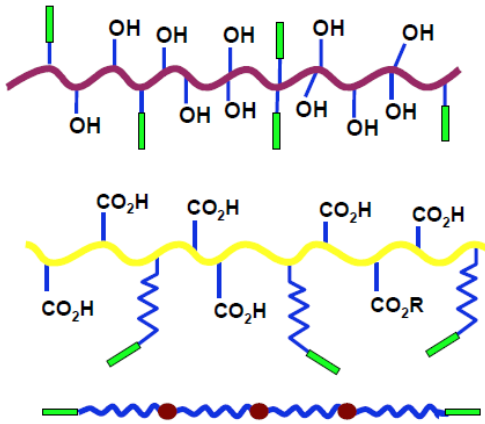
	Water Phase Thickeners	Associative Thickeners
Nonionic Polymers	HEC *HydroxyEthylCellulose*	HMHEC *Hydrophobically Modified HydroxyEthylCellulose*
	MC/MHEC/MHPC *MethylCellulose and EO/PEO mixed ethers*	HEUR *Hydrophobically Modified Ethoxylated Urethane*
		HMPE *Hydrophobically Modified PolyEther*
Anionic Polymers	CMC *CarboxyMethylCellulose*	HASE *Hydrophobically modified Alkali-Swellable-Emulsions*
	ASE *Alkali-Swellable-Emulsions*	

Structure

HMHEC	300
HASE	200-1,000
HMPE/HEUR (NSAT)	20-100



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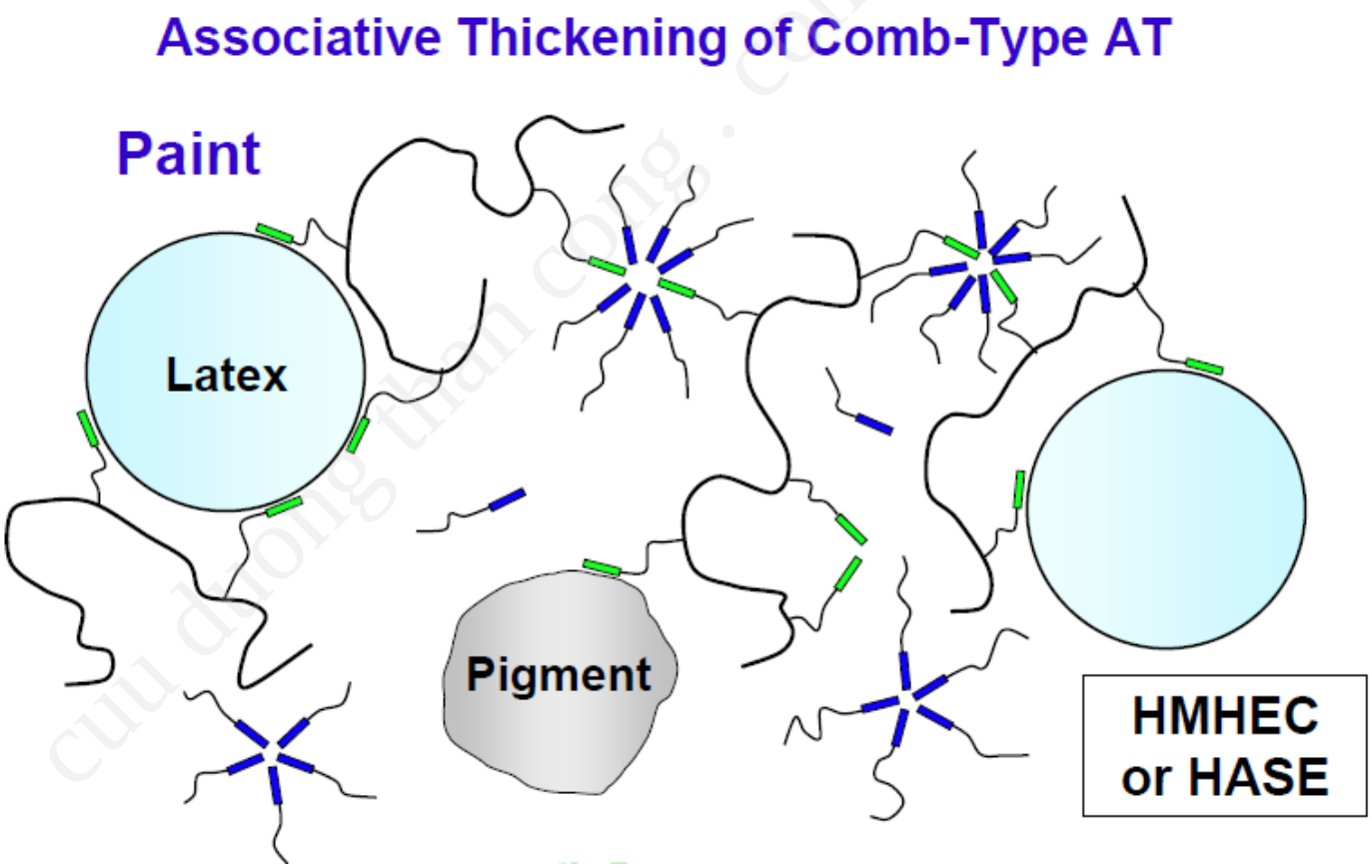

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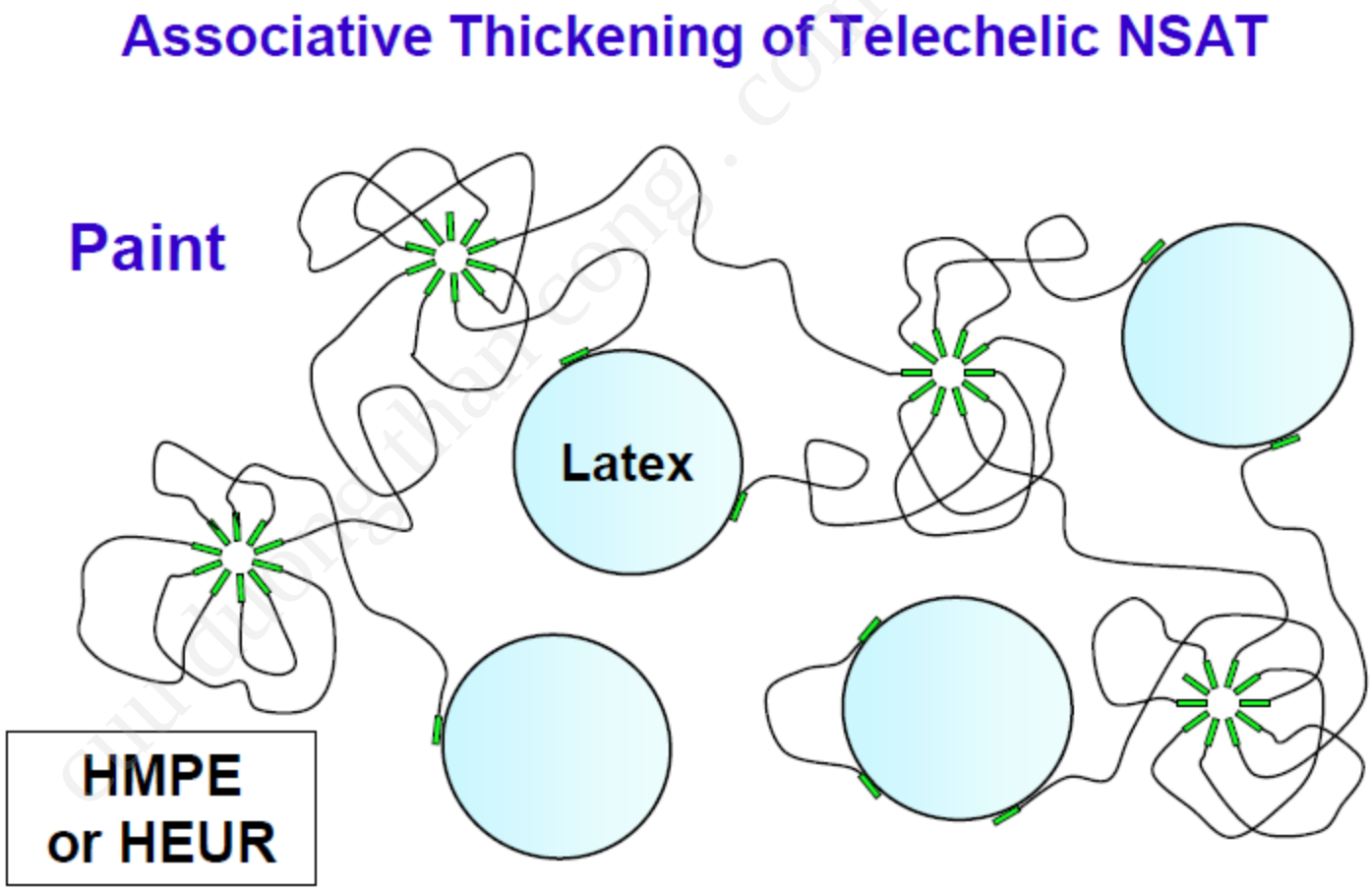

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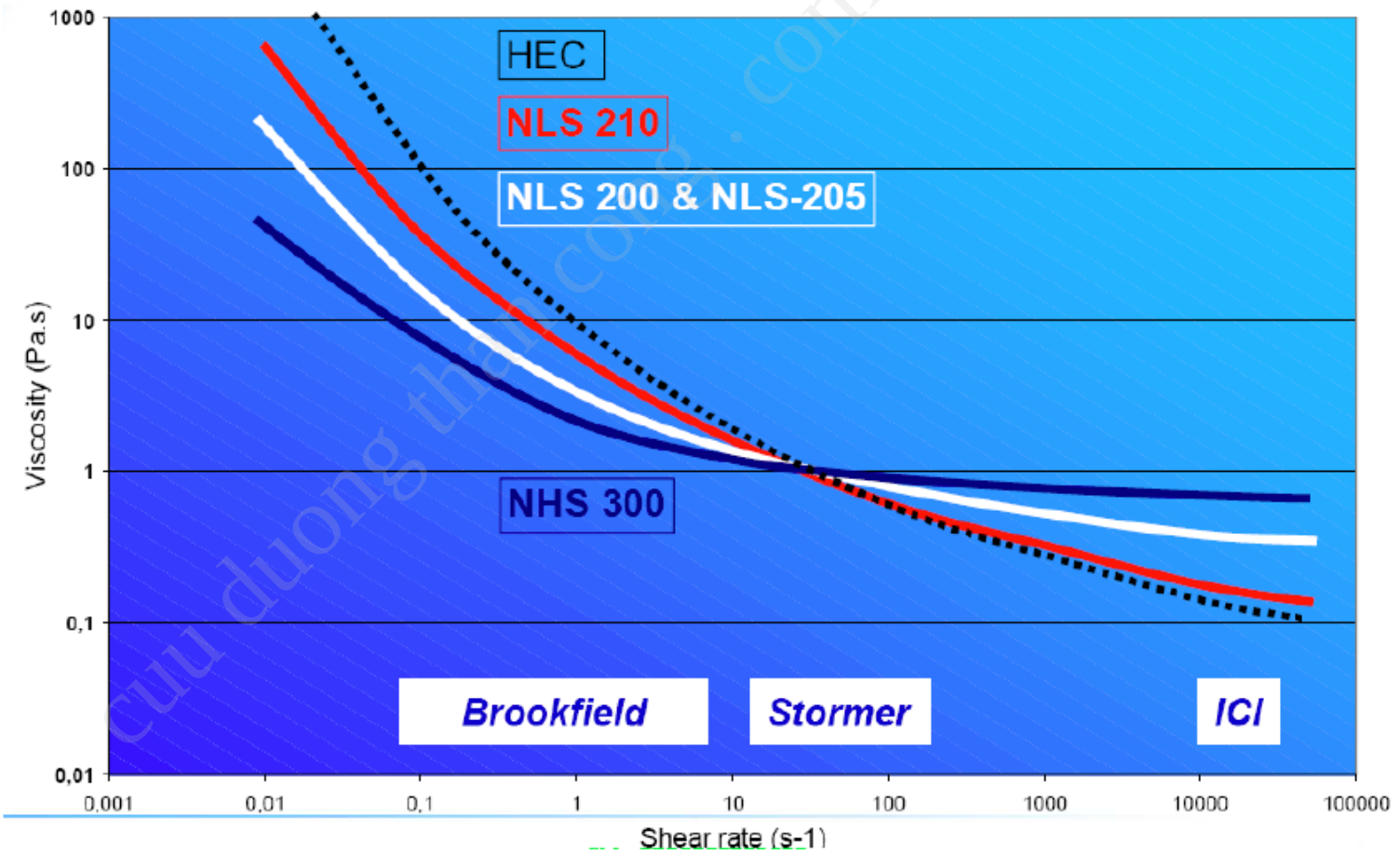
Rheology profile



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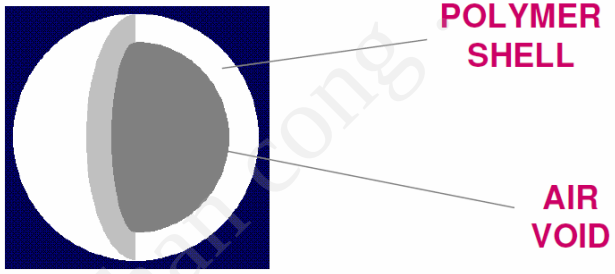
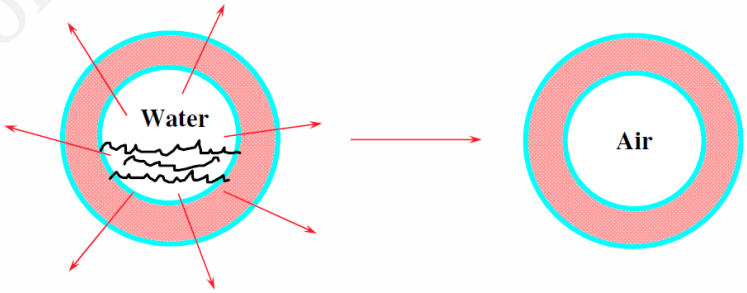
Function: provide opacity on dry film
Description: hollow polymer particles



Working mechanism



Wet
$\Delta_{R/I}$ =1.55-1.33
=0.22

Dry
$\Delta_{R/I}$ =1.55-1.0
=0.55

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KEYS PAINT MANUFACTURERS IN VIETNAM

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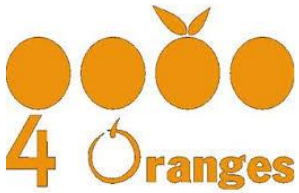

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- Video clip – plant introduction

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Q & A ?

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THANK YOU

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