SI Group®
The Substance Inside

Coatings – Product Portfolio Overview

Univar

Paolina Knezevic
Tech. Service Manager

July, 2021

Content – Paint & Coatings

- SI Group offerings
- Basic Technology
- Applications
- Q&A

Paints & Coatings: Components – SIG Offerings

- SI Group offers a range of products for coatings applications (overlapping products for other applications)

Basic Composition – liquid paint*

- **Resin(s)** (basic polymer, binder)
- Pigments
- **Solvents*** (diluents, thinners)
- **Additives**

SIG offerings

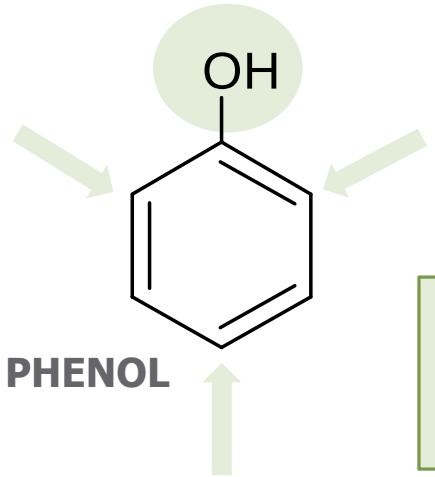
- **Resins**
  - Phenolic resins – solid, liquid
- **Additives**
  - Antioxidants
  - UV Stabilizers
- **Solvents**
  - High boiling point
- **Intermediates**
  - alkylphenols

Product Brochure

* Powder coatings, UV/EB coatings

SI Group

Phenolic Resins



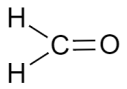
PHENOL

Phenolic resins
Condensation
Phenols
+
Formaldehyde

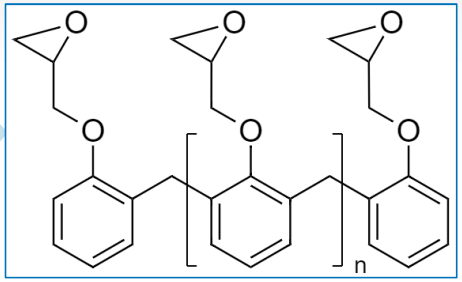
OTHER PHENOLIC MATERIALS:

Bisphenols: BPA, BPF, BPS
Alkylphenols:
- Cresols: o- m- p-
- Xylenols: 6 isomers
- PTBP (C4 alkyl)
- PTOP (C8 alkyl)
- PTAP (C5 alkyl)
- PHP (C7 alkyl)

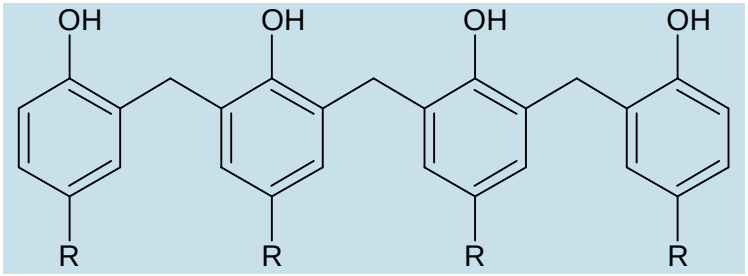
FORMALDEHYDE



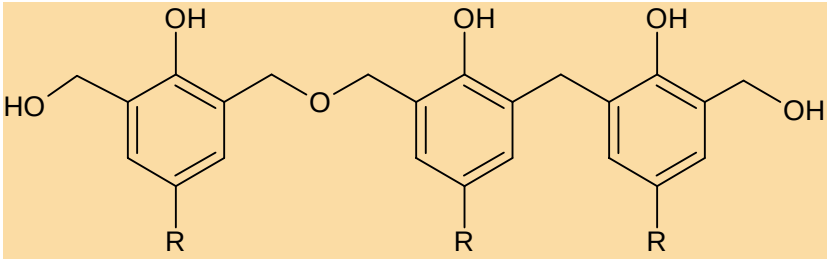
EPOXY NOVOLACS
BPA free solutions
More expensive
RT curing with catalyst



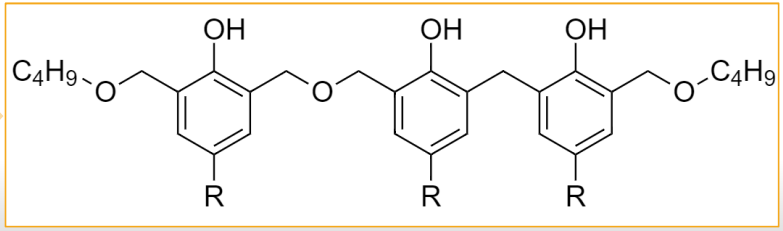
NOVOLACS
P > F
Thermoplastic
NOT self-condensing
External curing agent
Stable



RESOLES
P < F
Self-condensing
Reactive
Not stable
Solid or solution



ETHERIFIED RESOLES
Less reactive
More stable
More flexibility
Heat curable



Phenolic Resins in Coatings

- Less used in coatings alone or as primary – rigid, low color stability – yellow (coloring), require heat curing
- But offer – great corrosion, moisture, chemical resistance (acidic), great physical properties of hardness, scratch resistance, offer very good thermal stability, versatility (targeted flexibility), great adhesion on various substrates (metal), easiness of application, low condensate, lower cost
- Drawbacks are overcome - by blending with other materials (epoxy, alkyd, polyester, PVB, …) – chemical or physical

Application	Resin type	More info	System with
Metal Packaging	Resols Etherified resoles	Interior Can coatings (food, beverage, caps & closures, aerosols, tubes, industrial containers, drums)	Epoxy, polyester, PVB, alone too
Industrial coatings for: Anti-corrosion Performance	Resols Novolacs Epoxy Novolacs	Tank linings, machinery, pumps, hoods, pipes, wash primers, oil/alkyd paints – marine, residential Coil coating – HVAC coatings	Epoxy, alkyd, polyester, alone
Electrical insulating coatings	Resols Etherified Resoles	Primary (wire) and Secondary impregnation of electrical components for insulation (motor, stators, transformers)	Alkyd
Printing Inks	Resols Novolacs	Modifiers for rosin esters for flowability, viscosity, pigment dispersion, adhesion of the ink on substrates	Rosin and other rosin modifiers (alcohols, acids, anhydrides)
Powder Coatings	Novolacs	Curing agent and modifier for epoxy powder coatings	Epoxy





Packaging & Industrial Coatings – Interior Metal Substrates

- Chemical resistance (acid, salt, sulfur, resistant to stains), ease of application, thermal resistance (sterilization process), lacquers or enamels
- Interior can coating, side seam coating (3-piece-cans/drums) – steel or aluminum

- **Types of Metal Packaging (Food, B&B Packaging, General line)**
  - **3-piece cans, FAEOE** – steel (TFS), tin coated steel – food, meat, vegetables, fruit, soups, tomato, …

3-piece-cans

  - **2-piece cans, EOE** – aluminum, steel – food & beverage
    - Single-Drawn Cans – tuna, sardine, ready-meals
    - Drawn & Redrawn (DRD) cans – larger than SD – food cans
    - Drawn & Wall-Ironed (DWI/DI) cans – change in thickness through ironing process – beverage cans

2-piece-cans

  - **Caps and closures** – aluminum, steel – Twist-off caps/lids, Screw caps (ROPP), Press Twist (PT) caps, Crowns
  - **Aerosole (Monoblock)** – aluminum, steel – spray applications (food, cosmetics, maintenance)

Aerosol - Aluminum

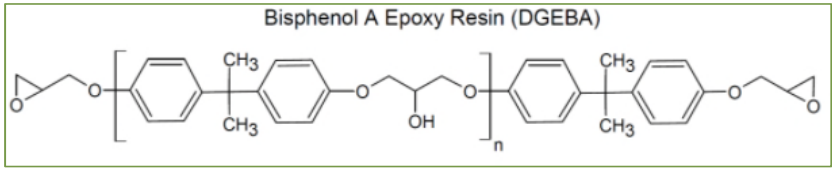
  - **General packaging** – cans, drums, pails, industrial containers

SI Group

Types of Resins for Metal Packaging

Type of Resin	Application		Pros	Cons
Epoxide	Inside	Outside	Chemical resistance, flexibility, low condensate	BPA, BPF
Phenolic	Inside		Chemical/corrosion resistance, Sulfur stains	Low flexibility, color
Polyester	Inside	Outside	Flexibility, versatility	Chemical resistance
Acrylic	Inside	Outside	Color stability, adhesion	Chemical resistance
Alkyd/Oleoresionous		Outside	Flexibility, corrosion	Color, odor, chemical resistance

- **Epoxy-Phenolic system 80:20 – 50:40**
  - Outstanding chemical resistance and flexibility for a wide range of products
  - Enhancement of adhesion, particulary to difficult substrates (4, 7, 9)
  - Due to unique properties it is difficult to replace by alternatives.
  - Although universally used in food contact applications for long period (over 40 years) and more is known about the toxicology of epoxy/phenolics than most other alternatives – deselection of DGEBA/BPA/BPF resins (phenolic and epoxy) – carcinogen/endocrine activity

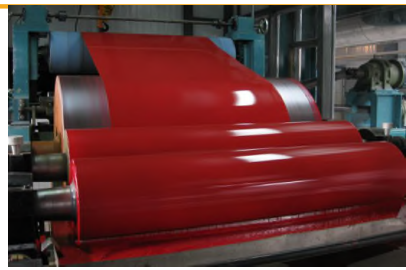


- **Replacement Technologies:**
  - Polyesters instead of epoxy – not the same level of flexibility, chemical resistance, adhesion on substrate, but PE are very versatile
  - Friendlier phenolics (cresoles, xylenols); ULF – ultra low formaldhyde resins (< 0.1%); no formaldehyde resins
  - New epoxy resins – structural blocks based on different than BPA phenols.
  - New technologies - PODs

SI Group

Industrial Coatings

- **Coil Coatings** – pre-painting of metal coils (aluminum, steel) for posterior forming – very fast, fully automated
  - building (metal roofs, garage doors, panels, rainware installations), automotive (pre-primed panels, trailers), appliances, HVAC, furniture, can ends, …



- **Anti-corrosion coatings and primers (Wash/Shop primers) for metals:**
  - Phenolic or phenolic-epoxy or epoxy-novolacs or alkyd-phenolic (PU, …)
  - Solvent, water based or no solvent
  - Spray coated, dipped, electrophoretic dipping (priming automotive bodies, accessories)
  - Oven (heat dried) or cold curing
  - tanks, pipes, machine housings, machinery, bridges, ships, metal constructions, …

- **Oil/Alkyd Paints**
  - Resoles and Novolacs are both used
  - Blended hot (reacted, only resoles) or cold (physical mixture, novolacs preferably, but resoles as well) – phe:alk 1:1 to 1:3
  - Phenolic part improves hardness, weatherability, moisture resistance, adhesion to substrate, alkyd flexibility
  - Solvent or water based

SI Group

Electrical Insulating Coatings & Inks

Electrical Insulating Varnishes

- Rarely phenolic alone due to low flexibility, but for modification of alkyds – adds thermal stability, insulting properties, color (tinting)
- Resoles primarily – solid or in solution, also etherified resoles
  - Primary – wire itself, varnishes – phenolic used as additives to alkyd for higher thermal resistance
  - Secondary – enclosures of electrical components – phenolic alone or with modifiers (epoxy, polyester)

Inks

- Tied to coatings – not covering the entire area, no protective purpose, but decorative, informative
- Rosin (pine chemistry, abietic acid) main components – modification for performance
- Off-set printing inks
- SIG offering:
  - Alkylphenols – PNP, PTOP
  - Resins – resoles and novolacs
  - Additives - AOX
  - Function: modifiers for rosin esters for flowability, viscosity, pigment dispersion, adhesion of the ink on substrates

SI Group

SIG Resins – Resols in Solution – Liquid Form

Resin	Application	Solvent
SFC-112	Metal packaging, 2-piece DRD, 3-piece – **flexibility, light color**	n-Butanol
SFC-144	Metal Packaging, 2-piece DRD, 3-piece – **flexibility, light color**	Xylene
FB-110 XB50	Metal Packaging, 2-piece DRD, 3-piece – **reactivity, gold color**	Xylene, n-Butanol
SFC-138B	Metal Packaging, 2-piece DRD, 3-piece – **reactivity, gold color**	n-Butanol
HRJ-13804	Tinting resin – **gold color**	n-ButOH, i-ButOH, Glycol Ether PM
FB-209 BT57	2-piece DRD, 3-piece – **reactivity, chemical resistance, light color**	n-Butanol, Toluene
FB-210 B60	2-piece DRD, 3-piece – **reactivity, chemical resistance, light color**	n-Butanol
L19-M3 42	Ready phenolic + epoxy system, 3-piece, 2-piece (DRD), light color	n-ButOH, EDG, S150
FB-250 XB50	Wash primer (anti-corrosive primer) – **chemical resistance**	Xylene, n-Butanol
HRJ-13078	2-piece DWI for beverage cans (not stand alone, minor component), water based, yellow	Water

SI Group

SIG Resins – Resols - Solid Form

Resin	Monomer	Application
FB-190	PTBP based	2-piece DRD, 3-piece – **flexibility, high reactivity, higher chem resistance, not stable in solution**
SP-103	PTBP based	2-piece DRD, 3-piece, alkyd modifiers – **flexibility, light in color**
HRJ-1367	PTBP based	2-piece DRD, 3-piece, alkyd modifiers – **flexibility, light in color, higher reactivity than SP-103**
SP-134	PTBP based	2-piece DRD, 3-piece, alkyd modifiers – **flexibility, light in color, higher heat resistance**
SP-1045	PTOP based	2-piece DRD, 3-piece, alkyd modifiers – **very flexible, light in color**

SIG Resins – Novolacs - Solid Form

Resin	Monomer	Application
HRJ-12952	Phenol based	Hardener for epoxy powder coatings
SMD-31144	PTBP based	Medium softening point, modifiers for alkyds, inks
SMD-31144HT	PTBP based	High softening point, modifiers for alkyds, inks
ELAZTOBOND™ 6000	PTOP based	Medium softening point, modifiers for alkyds, inks
HRJ-11937	PTBP based	Very high softening point, modifiers for alkyd paints, inks

SI Group

Powder Coatings

- Powder Coatings – refer to the application of the coating – dry, free-flowing powder, lower melting point, applied electrostatically and cured under heat or UV light
- Resins used: Polyester, hybrid polyester/epoxy, epoxy, PU, acrylic
- Can be: thermoplastic, thermoset (with curing agent), UV-curable
- Pros: no solvent, no EHS hazard, no VOC, no loss of material (powder reused), installation smaller, heating cost smaller, allow high level of productivity and automatization
- Cons: standardization of the color, color changing more difficult, more difficult to reach internal surfaces, thicker, harder for non-metallic surfaces
- Used: metal furniture, aluminum windows, door frames, electro-domestic appliances, pipes, metal packaging, automotive parts, bicycle frames, …

- **SIG offerings**:
  - **Resins** - Lower molecular weight Novolac resins (Mw=500-2000):
    - Epoxy:phenol powder coating blends= 90-10 to 60:40
    - HRJ-1166, HRJ-12952 - high chemical resistance, low color stability, oil pipes
  - **Additives –** AOX & UV Stabilizers

SI Group

Additives for Coatings

- Performance of coatings further increased by the use of additives:
  - during the coating resin preparation (alkyds, polyesters, …)
  - enhancing stability of the paint during manufacturing, storage and application (curing, baking at high temperatures)
  - improving the service life

- Additives – thermally stable and non-volatile during processing and curing, not discoloring

- **SIG offerings:**
  - **Antioxidants**
    - Primary AOX
    - Secondary AOX
    - Blends of primary and secondary AOX
  - **UV Light Stabilizers**
    - UVAs – UV Light Absorbers
    - HALS – Hindered Amine Light Stabilizers

SI Group

Additives - Antioxidants

- Preventing oxidation of the polymer subject to heat exposure, non regenerative
- 2 major classes and their blends, SIG offerings:

1. **Primary Antioxidants:** hindered phenolic – stabilization over service life of the coating – radical scavengers (ANOX™, LOWINOX™)
2. **Secondary Antioxidants:** phosphites – stabilization during the processing/application of the coating (ALKANOX™, WESTON™, ULTRANOX™)
3. **Antioxidant Blends** of 1 & 2 – combined AOX effect (ANOX™ BB011)

- **Selection:**
  - General use AOX: Anox 20, Anox PP18
  - High activity non-discoloring AOX, low volatility, polymers (no migration), low extraction: LOWINOX 44B25, LOWINOX CPL, LOWINOX 1790 (replaces LOWINOX GP45)
  - Liquid or solid, melting point for powder coatings

ANOX™ 1315
- Primary AOX – hindered phenolic
- Liquid - handling
- Low emission vs. AOX-1135 type
- Great compatibility and low migration
- Non-discoloring, low viscosity
- Low freezing (< - 20 °C)

WESTON™ 705
- Secondary AOX – phosphite
- Liquid - handling
- Regulatory compliant – nonylphenol free
- Higher phosphorus content than alternatives
- Used as TNPP drop in
- Replacement for solid ALKANOX 240 – AOX 168 type

SI Group

Additives – UV Light Stabilizers

- Photo-oxidation and degradation of the polymer – photochemical reactions caused by absorbed UV light
- 2 major groups of materials, both regenerative, SIG offerings – LOWILITE™:

1. UVAs – UV Light Absorbers:

- Absorb the light at certain wave length and dissipate into heat
- Choice depends on the system, other components, coverage required etc.

1. Benzophenones – older class, regularly replaceable coatings, lower band coverage – LOWILITE 22
2. **Benzotriazoles** – widest coverage of UV spectra, deactivated by metals, amines – LOWILITE 26, 28, LOWILITE 234 (not SVHC)
3. Triazines – in development

2. HALS – Hindered Amine Light Stabilizers:

- Scavenge radicals formed by interaction of light with the polymers
- **Monomeric** (LOWILITE 77, 92) or **polymeric** (LOWILITE 19, 62, 94) – migration
- **Basic** (LOWILITE 19, 77, 92, 94) or **Non-Basic** (62) – Basic have interaction with acidic catalysts and pigments
- In addition to UV Stabilizer effect of HALS they are also used as tribo-charging additives in powder coatings – they improve electro-chargeability of powders – 0.1-0.3% - LOWLITE™ 62 & 19

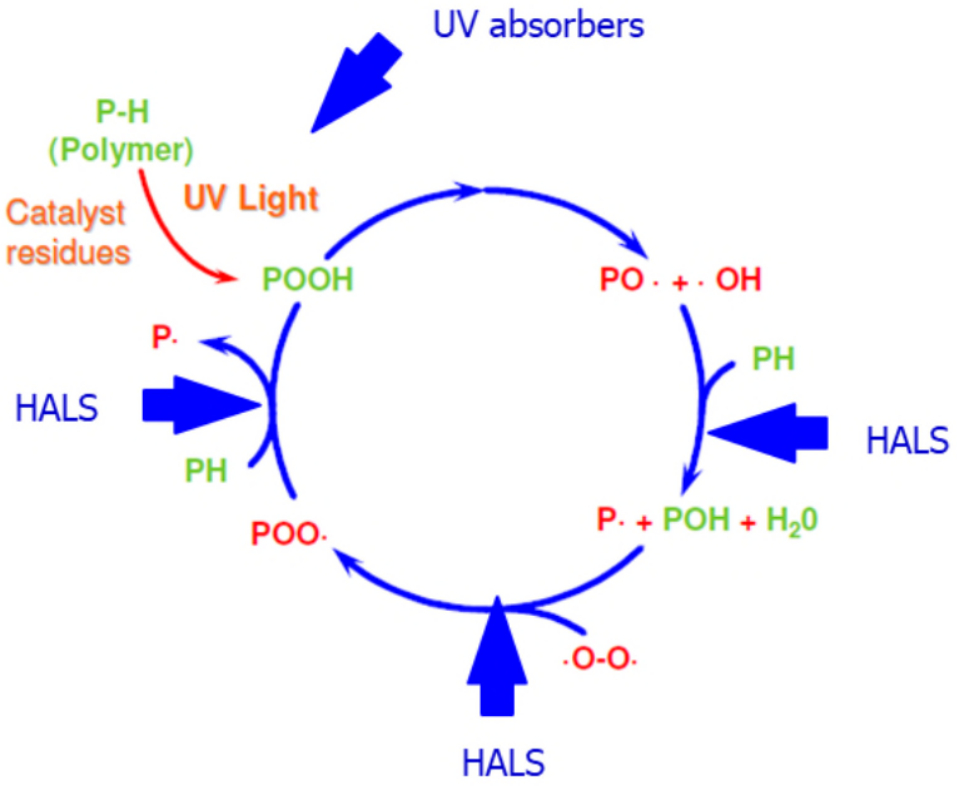
3. BLENDS - Blends of AOX & UV light stabilizers:

- Liquid - LOWILITE UV B1260 – blend of primary AOX + UV stabilizers

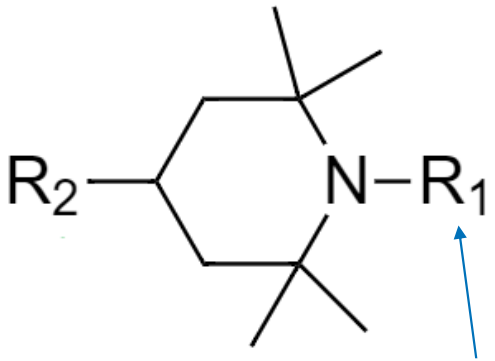
SI Group

Additives – UV Light Stabilizers

UVAs – mechanism of activity



HALS – typical structure

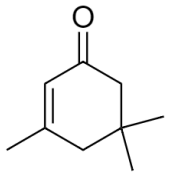


R1 – "Head Group" determines Basicity

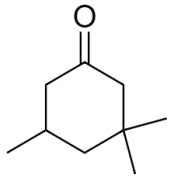
SI Group

Solvents & Chemical Intermediates in Coatings

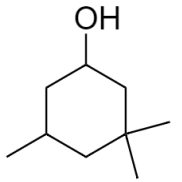
- **Solvents,** manufactured in India, from acetone production and subsequent hydrogenations:
  - **Isophorone**
    - Clear liquid, peppermint odor
    - Boiling point 215 °C
    - Used as solvent printing inks, coatings (leveling agent), also chemical intermediate (Ag chemicals)
    - CAS 78-59-1



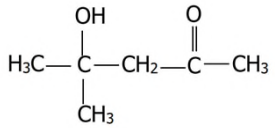
  - **TMCON** – 3,3,5-trimethylcyclohexanone
    - Clear liquid
    - Boiling point 189 °C
    - Used as solvent printing inks, coatings (leveling agent), also chemical intermediate (polycarbonates, peroxides)
    - CAS 873-94-9



  - **TMCOL** – 3,3,5-trimethylcyclohexanol
    - Clear liquid, minty odor
    - Boiling point 195 °C
    - Used as chemical intermediate (sunscreen protection intermediate for Homosalate 45% of the sunscreen)
    - CAS 116-02-9



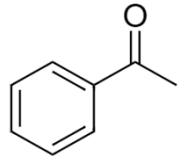
  - **Diacetone Alcohol**
    - Colorless, odorless liquid
    - Boiling point 169 °C
    - Used in cellulose ester lacquers, produces brilliant gloss and hard film, where the lack of dor is needed, lacquer thinners, wood stains, printing inks
    - CAS 123-42-2



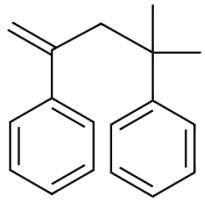
SI Group

Solvents & Chemical Intermediates in Coatings

- **Acetophenone**
  - Colorless to light yellow liquid, floral odor
  - Boiling point 202 °C
  - Used as solvent printing inks, coatings (leveling agent), also chemical intermediate (resins)
  - CAS 98-86-2



- **AMS-Dimer**
  - Chain Transfer Agent – CTA for polymers made by free radical polymerization (odorless, colorless, easy to handle, no discoloration)
  - Crosslinking agent
  - CAS 6362-80-7, isomers



- **Alkylphenols**
  - PNP, PTOP – epoxy coatings hardener, diluent, plasticizer – increase regulatory scrutiny
  - PNP, PTBP, PTOP – in preparation of printing inks; using AP vs using AP resole resins
  - Ethoxylated – NPE, OPE – non-ionic surfactants, pigment dispersants – regulatory scrutiny and deselection
  - Tristyrylphenol (TSP) and Monostyrylphenol (MSP) – TSP alkoxylates/phosphates – surfactants/emulsifiers for latexes
  - OSBP, OTBP
  - By CAS number

  - **PNP – para-nonylphenol**
    - Widely used in preparation of non-ionic surfactants, regulatory constrained, endocrine impact
    - In coatings: as reactive diluent, hardener – directly as is or chemically transformed into reactive diluent (epoxidized), into hardener – with amino functionality – Mannich bases (fast cure rate, no blushing)

SI Group

Additional info

Appendix: Paints & Coatings - Complexity

- **Complexity** due to:
  - **Significant number of different raw materials** – organic, inorganic, different forms (liquid, powders)
  - **Market diversity** – regions, regulations, applications
  - **Application technology –** increase productivity, improve performance, reduce environmental impact
    - Spraying
    - Dipping
    - Rollers, brushes, blades
    - Electrodeposition (powder coatings)
  - **Curing/setting technology** – integral part of paint development
    - Evaporation/drying of the solvent
    - Exposure to oxygen
    - Baking (1K systems)
    - UV curing
    - Mixing reactive components - 2K systems (epoxy, PU)
  - **Environmental impact** – elimination/reduction of VOC, powder coatings, UV/EB, high solids, friendlier materials

SI Group

Appendix – Paints & Coatings Categories

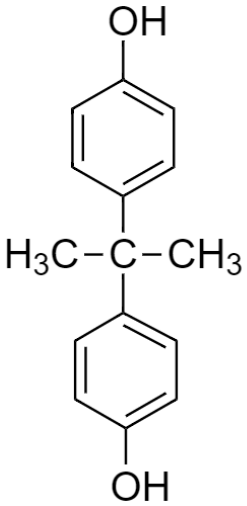
- **By Application Field**
  - **Architectural -** >50%
  - **Industrial -** factory application, OEM, ~ 35%
    - Automotive
    - Machinery
    - Industrial (tanks, pipes)
    - Packaging
  - **Special -** field application, ~ 10%
    - Refinishing (automotive)
    - Industrial maintenance
    - Traffic marking paints
    - Marine (OEM, refinishing)

- **By Technology**
  - **Water borne - 50%**
  - **Solvent borne - 25%**
  - **Powder Coatings - 20%**
  - **Others (radiation curable, high solids)**

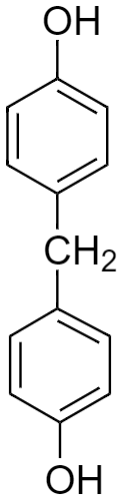
- **By Resin Type**
  - **Acrylic - 43%**
  - **Polyester - 17%**
  - **Alkyd - 14%**
  - **Polyurethane (PU) - 11%**
  - **Epoxy – 9%**
  - **Amino**
  - **Phenolic**
  - **Others**

SI Group

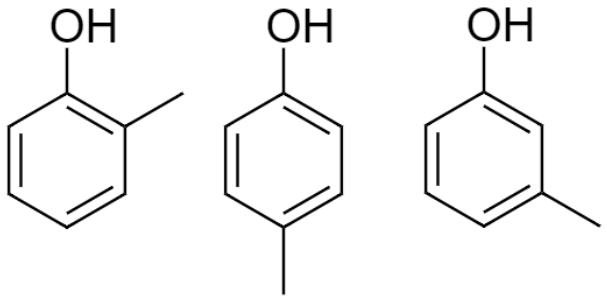
Appendix - Other Phenols



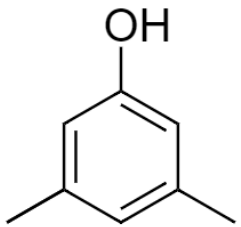
Bisphenol A
BPA



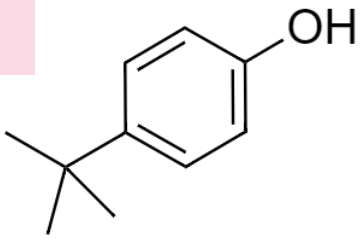
Bisphenol F
BPF



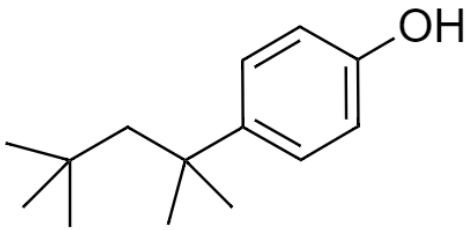
Cresols
o-Cresol p-Cresol m-Cresol



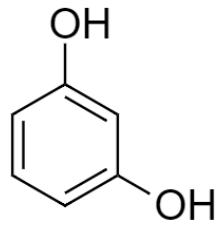
Xylenols (6 isomers)
3,5-Xylenol



PTBP



PTOP



Resorcinol

SI Group

Color & Stability

- Phenolic resins build up a color with age, no effect on performance (AOX)
- Solid resins – shelf life of 1 year
  - Sintering – heat, moisture
  - No effect on performance
  - Handling issues
- SIG Coating resins in solution have shelf life of 1 year @ max 23 °C
  - Can be extended by cold room storage ~ 15 °C
  - Not freeze sensitive
  - Exception HRJ-13078 – water based resin – 3 months shelf life at 5 - 10 °C, not freeze sensitive, precipitation upon cooling, but reversible.

SI Group

Appendix – Can Coatings

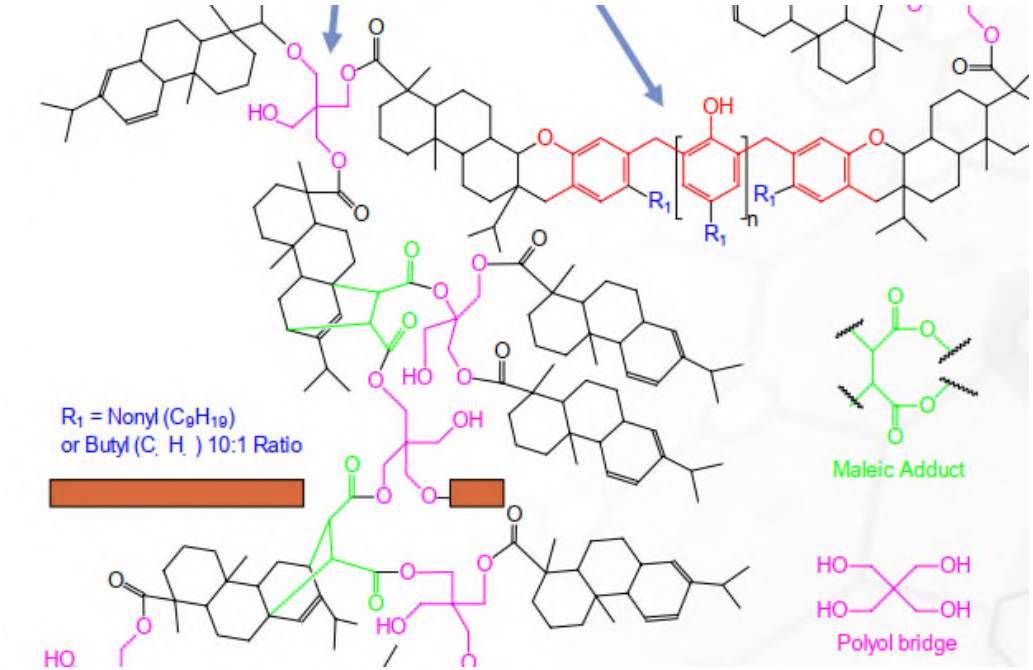
- **QUANTITY** of coating deposit:
  - B&B: spray process - 110-180 mg/330 ml – standard size aluminum can – 2-piece cans - DWI
  - FOOD: sheet process - 5-15 g/m^2 -3-piece food cans, 2-piece-single drawn (pre-coated)

- **POST-PROCESSING** – packed food, closed can
  - FOOD: sterilization @ 121 °C/ 90 minutes under 1 bar pressure
  - BEER: pasteurization @ 50-80 °C/ 30 minutes
  - BEVERAGE: no treatment (soda)

Old info – needs update

Appendix – Inks Structure

Complex printing ink resin structure: rosin ester adduct modified with phenolic resin - resole



Ink resin structure origin:

Black: Rosin
Red: Resole – nonyl or octyl or butyl
Purple: Alkohol - NPG
Green: Maleic anhydride

SI Group

X-check list – Georgia-Pacific

ETHERIFIED RESINS	Solids, %	Viscosity, cP (@ T?)	Solvent	FF, %	Phenol, %	SIG	Comm
GP 7571	68-72	2500-3700	n-Butanol			FB-210 B60 (SFC-220)	Low color
GP 7565 LF	68-72	2500-4000	n-Butanol	<0.5			
GP LB-7575	58-62	200-1000		<0.1	<0.1 BPA		

LOW MONOMER NOVOLACS	Free Phenol, %	Melt Viscosity cP @140 °C	Softening Point, °C	Tg, °C	SIG
GP CL-7002	0.2 max	~1000	98-102	51	REZICURE™ 3020
GP CL-7003	0.2 max	~2500	106-110	55	REZICURE™ 3026
GP CL-7004	0.2 max	~9000	117-123	72	REZICURE™ 3057
BITREZ CURAPHEN 22-506			80-90		REZICURE™ 3010

SOLID NOVOLAC RESINS	Solids, %		Color, max	Soft point, C	SIG
GP CK-2500		100	8	104-116	
GP CK-2420		100	6	120-139	SC-204
GP CK-2400		100	8	143-157	HRJ-11937
GP CK-2103		100	5	102-118	

WATERBORNE DISPERSIONS	Solids, %	Viscosity, cP (@ T?)	SIG
GP BKUA-2353	43-47	2000-5000	no
GP BKUA-2370	44-48	4000-9000	no
GP 4003	44-48	1500-3500	no

SOLID RESOLE RESINS	Soft point, C	SIG
GP BKR-2620	82 - 99	HRJ-1367, SP-103

SOLUTION RESOLE RESINS	Solids, %	Viscosity, cP (@ T?)	SIG	Comm
GP BLS-2700	54-58	300-450	FB-250 BX50	similar to BKS-2600
GP BKS-2640	45-49	300-900	SFC-112/65	solution of BKR-2620
GP BKS-2600	52-56	700-1000	FB-250 BX50	
GP BKS-2603	62-66	750-1500	FB-210 B60, SFC-138	
GP BKS-2605	62-66	750-1500	FB-210 B60, SFC-138	
GP BRSD-2112	57-63	40-100	BRJ-473	

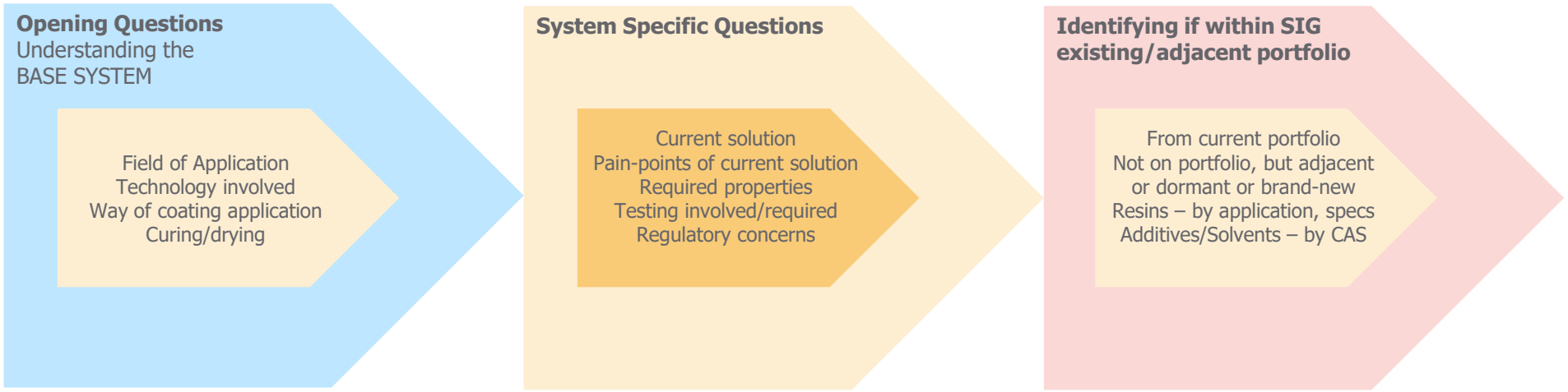
BITREZ RESINS			
SOLID RESOLE IN SOLUTION	Free formaldehyde, %	Characteristics	SIG
CURAPHEN 40-412 BBG51	<0.2	PTBP free	FB-110 XB50
CURAPHEN 40-414 B50	<0.1	Mixed substituted phenols	SFC-220
CURAPHEN 40-718 B60	<0.5	PTBP based	SFC-112/65
SOLVATED RESOLE			
CURAPHEN 40-809 B60	<0.5	BPA based	FB-210 B60
CURAPHEN 40-815 BX57	<0.5	BPA based	FB-209 BT57
CURAPHEN 40-825 B63	<0.5	Phenol based	FB-250 BX50
CURAPHEN 40-827 B73	<0.5	Phenol based	FB-250 BX50
CURAPHEN 40-888 B60	<0.5	Phenol based	FB-250 BX50
CURAPHEN 40-830 B55	<0.2	Phenol based	FB-250 BX50

Other competitors:

- Allnex
- Hexion
- Sumitomo-Durez
- Huntsman

SI Group

Appendix – Suggested Questions - Flow



SI Group

Appendix – Suggested Questions

- **Opening/Probing Questions:**
  - **What kind of coatings the customer provides per filed of application?** (Architectural, Industrial, Special)?
    - Which sub-application? (Example: Industrial → Automotive → OEM or Refinishing – auto-body or automotive part?
    - What substrates? (metal, concrete, wood, …)
  - **What is the base chemistry (base polymer, system)?** (Epoxy, polyester, acrylic, PU, alkyd, … - customers usually have more, try to uncover where we can play.
    - What sub category? (Example: PU → thermoplastic or thermoset? → 2k or 1k system? – aliphatic or aromatic?)
    - What technology? (Water based, solvent based, powder resins, UV curable)
    - If solvent, which solvent?
  - **How is it applied?** (by spray, brushing, dipping, powder coating)
  - **How the material has to be set, cured?** (by plain drying (solvent evaporation), cure initiated by oxygen (alkyds – which catalysts), heat induced (ovens, blowing hot air), bringing reactive parts of systems together (at room Temp), so called 2K (2-component systems)?
    - Material/system thermoplastic or thermoset? (Acrylics can be both thermoplastic (architectural paint) or used as thermoset (2K PU systems – 1 part acrylic, other parts isocyanates or 1K system (acrylic + amino – heat cured, stable system at RT)
    - Is it slow setting/curing or fast?

- **System Specific Questions - General:**
  - Is this new application for the customer? If not what is the exiting solution and they have to improve on the existent solution (cost, tech, 2nd supplier, supply chain, new form of delivery)? Pain points of the existing solution?
  - Needed properties of the final coating? What specs the material should have or be close to? What are the receiving material test requirements? What are the final coating test requirements/performance? What test are performed on the final coating?
  - Chemistry related questions: what type of catalysis (acids, organometallic, …)?
  - What additives they use? Any room for the additives we offer and higher boiling point solvents (by CAS)?
  - TDS/SDS/specs of the resin currently used?
  - Details of the application – curing details, operational regime (temperature, external/internal application), chemical resisatance?
  - Final customers profiles?
  - Any regulatory hurdles?

Appendix – Suggested Questions

- **System Specific Questions – Packaging Application:**
  - Internal or External Coating?
  - Related to food/cosmetics industry a need for FDA approval? Or general packaging application? What is the intended content of the can?
  - Type of the base polymer system: Does it have to be BPA-NI? Can it tolerate it? (ind. Applications - drums – epoxy-phenolic system still OK)
  - Currently used resin? What type? Monomer content? Solvent? Specs? TDS/SDS?
  - Color, flexibility, chemical resistance, heat resistance of the final coating?
    - Usual tests in can coatings:
      - MEK resistance (double rubs)
      - pack test (monitored coating adhesion/consistency over pre-determined test time, at certain temperature with the final food content)
      - Chemical resistance test (monitored coating adhesion/consistency over pre-determined test time, at certain temperature with different mimicking solutions (acid, salty, sulfur, …)
      - wedge bend (flexibility test) taste transfer test, hardness (stamping of pre-coated metal into cans)
      - electrical conductivity (should be dielectric, way to evaluate the quality of the finished coating, check for surface defects)
      - Sterilization (heat resistance)
      - Extractables components at certain chemical solutions (salty, acidic), etc.
      - Organoleptic testing – the coating should not have taste transfer to can content
      - Processing: easiness of application & condensate level (measure volatile emissions during curing of the coating, filter clogging, disruption in production)

SI Group

SI Group®

The Substance Inside