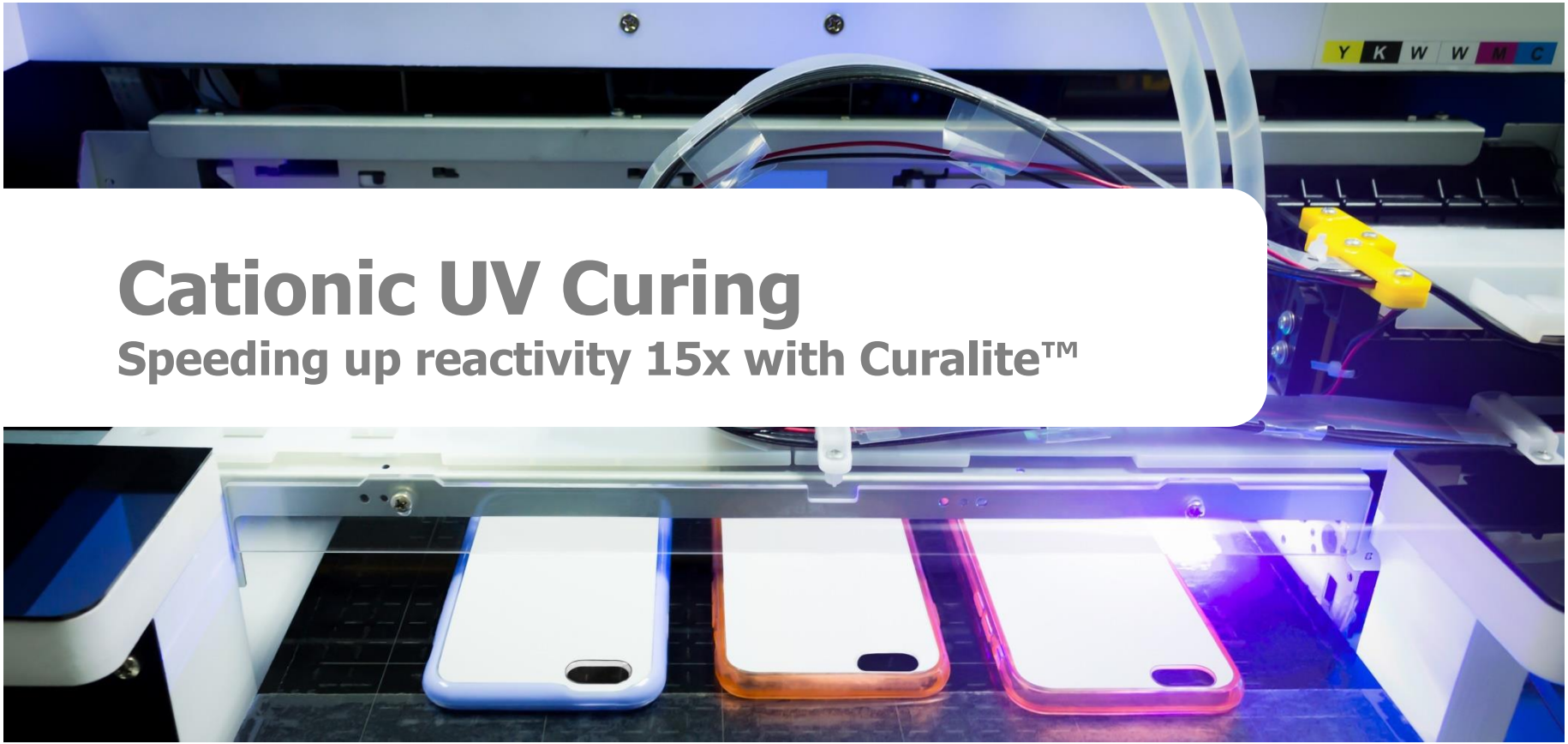

Cationic UV Curing

Speeding up reactivity 15x with Curalite™

European Coatings Show, April 5th 2017

Presented by David Engberg

Perstorp
WINNING FORMULAS

Introduction

Background

- MSc. In Chemical Engineering at the Faculty of Engineering at Lund University in Sweden.
- At Perstorp since 2007
- In previous role worked at Perstorp's department of technology

Speaker

David Engberg

Global Product Manager
Specialty Polyols

Perstorp
WINNING FORMULAS

Everywhere you need us

- World leader in several sectors of the specialty chemicals market
- Pioneer in formalin chemistry, plastics and surface materials
- Founded in 1881 in Perstorp, Sweden
- 135 years of winning formulas
- 1,500 employees in 22 countries

Different types of curing for food packaging

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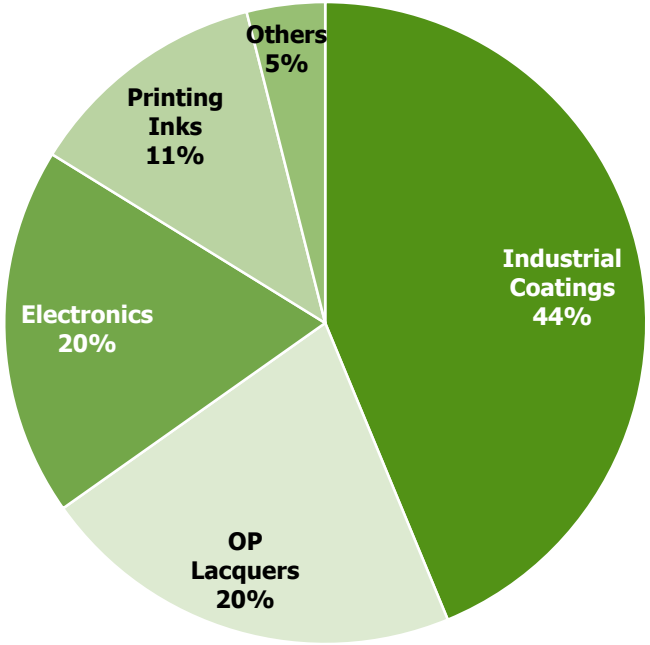
Technology	Advantages	Disadvantages/myths
Solvent and oil based	1. Long history and experience 2. Low cost 3. Variety of materials	1. High VOC 2. Slow drying 3. Migration
Water based	1. Seen as "safe" 2. Low VOC	1. Low solids 2. Slow drying 3. Limited suitability on impermeable substrates 4. Migration
Radiation curing	1. Space saving 2. Production speed 3. Versatile 4. VOC-free 5. Low energy 6. Low migration 7. Enhanced print quality	1. Often perceived as hazardous 2. Acrylates can have poor adhesion 3. Curing must be carefully controlled 4. Seen as high cost

Radiation curing applications

2016: 550,000 Tonnes



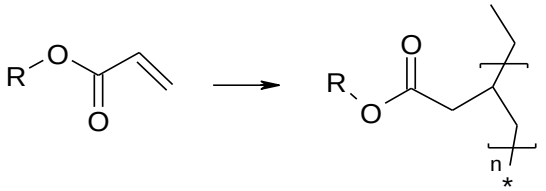
Reduction in traditional printing inks, increase in electronics and digital 3D

Two types of Radiation cure

Free radical curing

The dominant technology >95%

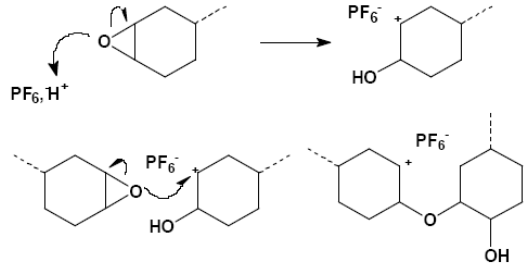
Curing by use of a radical generating photo-initiator or electron beam



Cationic curing

<5% of Radcure market

Curing by use of a "Lewis acid" generating photo-initiator



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Comparison of UV technology

Technology	Advantages	Disadvantages
Radcure **Free radical >95%**	1. Space saving 2. Speed 3. Versatile 4. VOC-free 5. Low energy 6. High quality/ high resolution	1. Often perceived as unsafe 2. Acrylates can have poor adhesion 3. Curing must be carefully controlled 4. Curing is affected by O2.
Radcure **Cationic <5%**	1. All of above 2. Exceptional adhesion on difficult substrates 3. No "Oxygen inhibition" 4. High chemical resistance 5. Exceptional flexibility 6. Low migration 7. Safe	1. Affected by amines and humidity 2. Limited range of raw materials

Main applications for cationic curing

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Graphic Arts

Exceptional adhesion giving low migration in sensitive applications like food packaging

Coatings

Outlasting perfromance on difficult substrates like metal, glass and plastic

Other

- Adhesives
- Silicone release agents
- Electronics

Cationic UV is the perfect choice for challenging applications

Cationic on challanging substrates

Plastics

- Polyethylene
- Oriented Polypropylene
- Polyester
- Polyacrylates
- Polycarbonate
- Polystyrene
- Polyvinyl Chloride
- Acrylonitrile-Butadiene-Styrene
- Thermoplastic Polyurethanes
- Polyamides

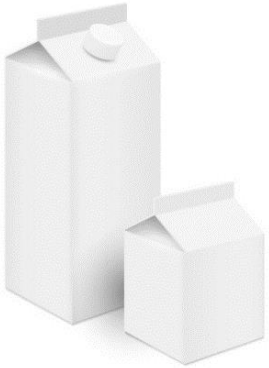
Metals

- Aluminium
  - Vacuum deposited
  - Anealed
  - Foils
  - Drawn containers
  - Monobloc
- Tin-plate
- Tin-free steel

Why cationic is great

Carton packaging

- Flexo printed
- Carton packaging for retorted food
- Alternative to traditional cans



Decorative Sleeves

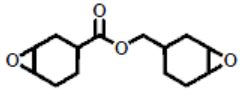
- Shrink sleeves
- “Gravure quality” print
- High shrinkage
- Superior scratch resistance

Beverage can-base

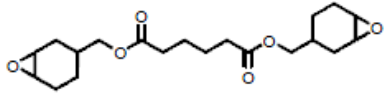
- Long term resistance and fast process
- Designed for slip and resistance

The Cationic formulation

Cyclo-aliphatic Epoxy

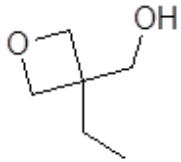


CAS No. 2386-87-0 UVR6105



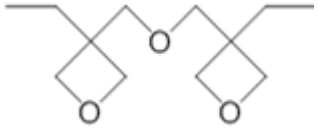
CAS No. 3130-19-6 UVR6128

Reactive Diluent



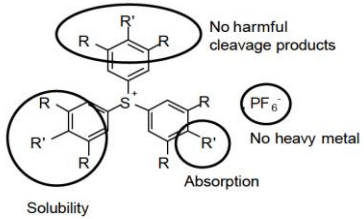
Curalite™ Ox

Crosslinker



Curalite™ OxPlus

Initiator



Irgacure 270

Modifiers – Polyols

- Polyether polyols
- Caprolactone polyols
- Dendritic "Boltorn" polyols

Others

- Additives
- Pigments
- Fillers

Our offer for Cationic formulation

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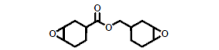
Reactive diluent/Crosslinker

- **Curalite™**
  Oxetane performance boosters

Cyclo-aliphatic Epoxy



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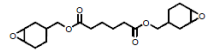

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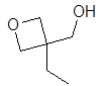
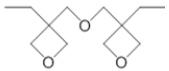


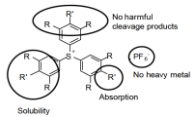
Curalite™ Ox

Crosslinker



Curalite™ OxPlus

Initiator



Irgacure 270

Modifiers – Polyols

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Others

- Additives
- Pigments
- Fillers

Modifiers – Polyols

Boltorn™
Multifunctional and highly branched dendrimers

Alkoxylates
High reactivity and safe polyethers

Capa™ Polyols
Cross-linkers and flexibilisers with high reactivity

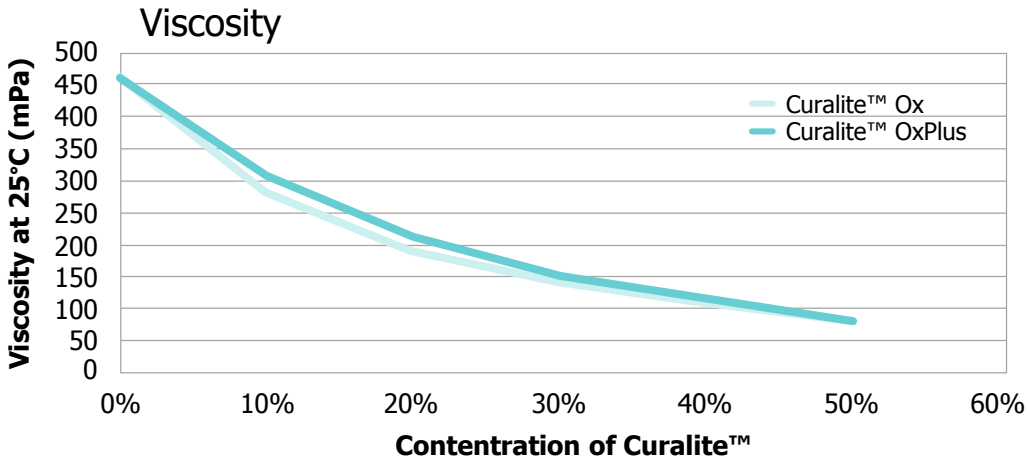
Introducing Curalite™

Reactive diluent

Modifiers – Polyols

- Increasing reactivity enabling faster printing speed
- Lowers viscosity
- Curalite™ Ox and Curalite™ OxPlus
- High availability of fresh material
- Non skin-irritating and low odor
- Fast and reliable supply
- Flexibility in order sizes

Curalite™ – Designed to enhance Cationic UV Curing



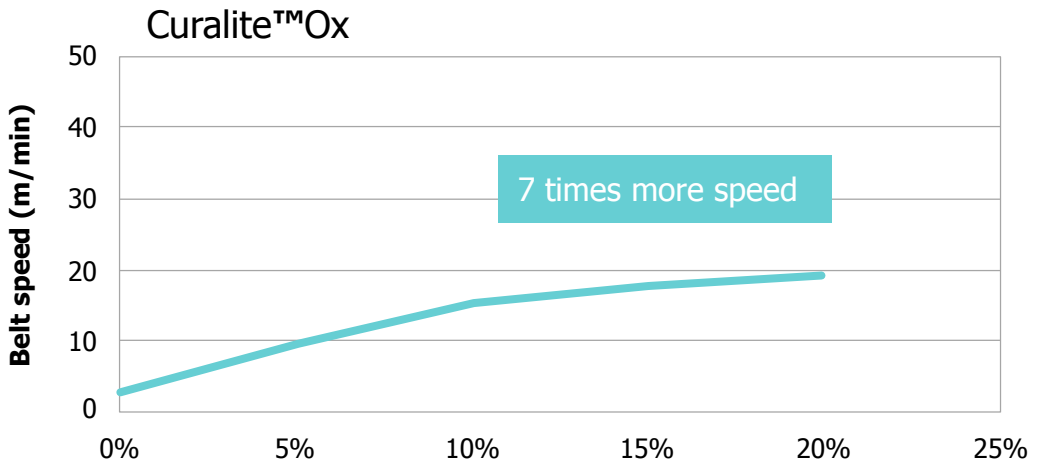
Curalite™ Ox

Reactive diluent

Modifiers – Polyols

- Increasing the reactivity up to 7 times
- Best performance for flexibility
- Suitable in formulation in the range of 5 to 20%
- Increased dark cure gives increased through cure

Speeding up your cationic formulation



Curalite™ OxPlus

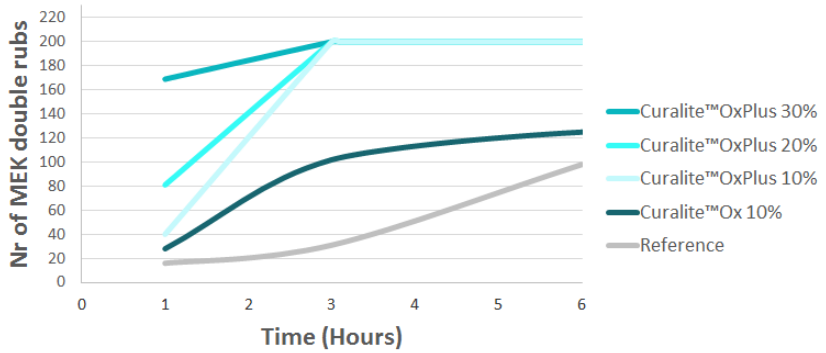
Give your formulation an extra edge

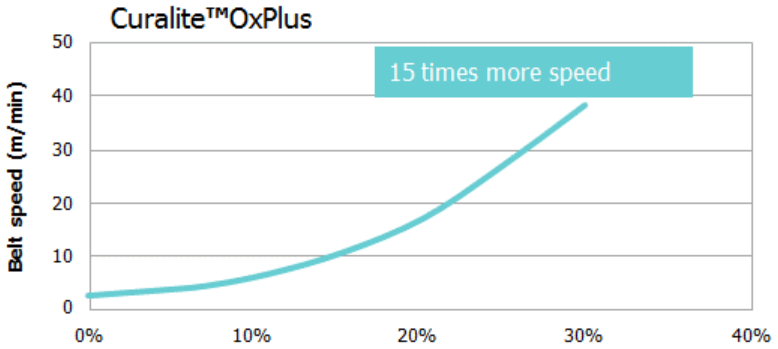
Reactive diluent

Modifiers – Polyols

- A di-functional Oxetane crosslinker
- Improved chemical resistance and hardness
- Increasing the reactivity up to 15 times
- Suitable in formulation in the range of 10 to 40%
- Use less amounts of expensive photoinitiator
- Perfect for environments with high humidity

Superior Through Cure





Dendritic Polymers – "Boltorn"

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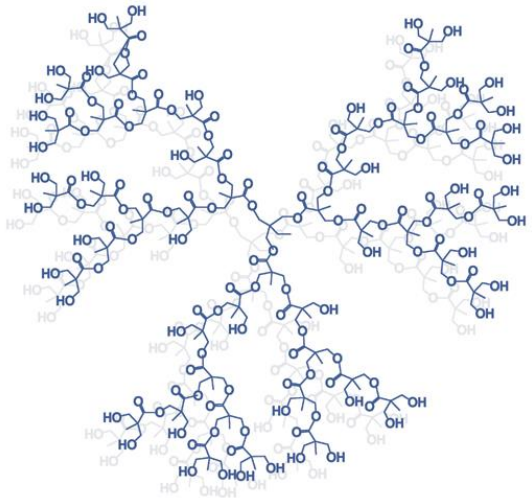
Reactive diluent

Modifiers – Polyols

Hyperbranched Polymers

- High functionality
- Densely branched polymer backbone



Boltorn™ H2004
recommended for cationic formulation

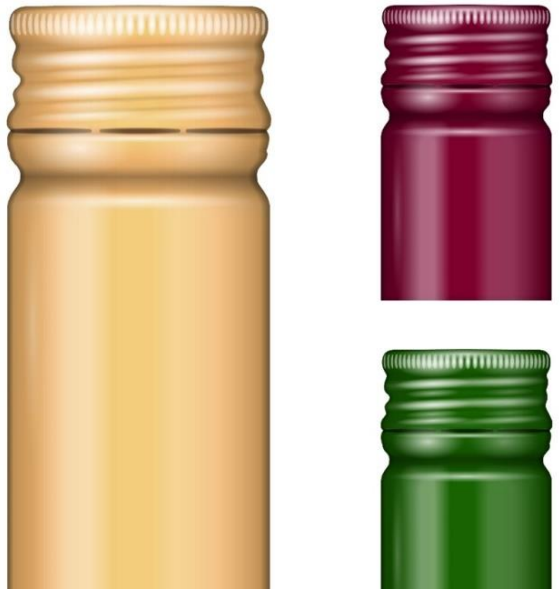
- Superior wear resistance, improved flexibility and rheological behavior
- Improves ink flow
- Improved flexibility
- Offers good cross-linking

Caprolactone Polyols

- Flexibility & toughness
- Low Viscosity
- Very low acid value
  - Prolonged shelf-life
- Di, tri and tetra functional grades

Reactive diluent

Modifiers – Polyols



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Polyether polyol

Broad offer in **polyols for cationic formulations**

- Di-, tri- and tetra functional polyols
- Ether bonds

Tailoring properties

Changing polyol and the ratio between epoxide/oxetane and polyol

Reactive diluent

Modifiers – Polyols

Alkoxylates for freedom when formulating

Thank you for listening!
Q&A

Welcome to booth 7A-603

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