RADTECH
THE ASSOCIATION FOR UV&EB TECHNOLOGY

DEMYSTIFYING UV & EB TECHNOLOGY

FOCUS: PRINTING INDUSTRY

A Webinar for Government Regulators, Technical Assistance Providers & New Users

Jan. 29, 2014
2:00 PM EST/1:00 PM CST

OBJECTIVES

- To educate those creating regulations
- To educate those enforcing regulations
- To educate those who assist companies to comply with regulations
- Offer an opportunity to connect with RadTech for more information

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SPEAKERS

Doreen M. Monteleone
Director of Sustainability & EHS Initiatives
RadTech

Lisa Fine
Technical Director
Joules Angstrom UV Printing Inks

Steve Lapin
Applications Specialist- BroadBeam
PCT Engineered Systems

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AGENDA

- What is RadTech?
- Ultraviolet (UV) & Electron Beam (EB) technologies
- Applications
- Comparison with conventional technology
- Regulatory impact
- Trends
- Resources

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WHAT IS RADTECH?

- Technical association for UV & EB technology
- Established 20 Years Ago
- More than 700 members
- Supports more than 20 manufacturing industries with printing being a major industry

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Fiber optics
CDs/DVDs
Over Print Varnish on paper
Screen printing
Coated labels
Premium no wax flooring
Ophthalmic plastic lenses (certain types)
RTA furniture
Automotive headlamps
Photoresists used in circuit boards and chip manufacture
Pre-finished hardwood flooring
MDF fillers
Particleboard fillers
Window film coatings
Photopolymer printing plates
Decorative films (certain types)

* End uses where UV/EB already holds a double digit share, ranging from 30% to close to 100%.

Printing Industry Technology

- Conventional
  - Water based
  - Solvent based
  - Oil based
- Energy Cured
  - Ultraviolet (UV)
  - Electron Beam (EB)

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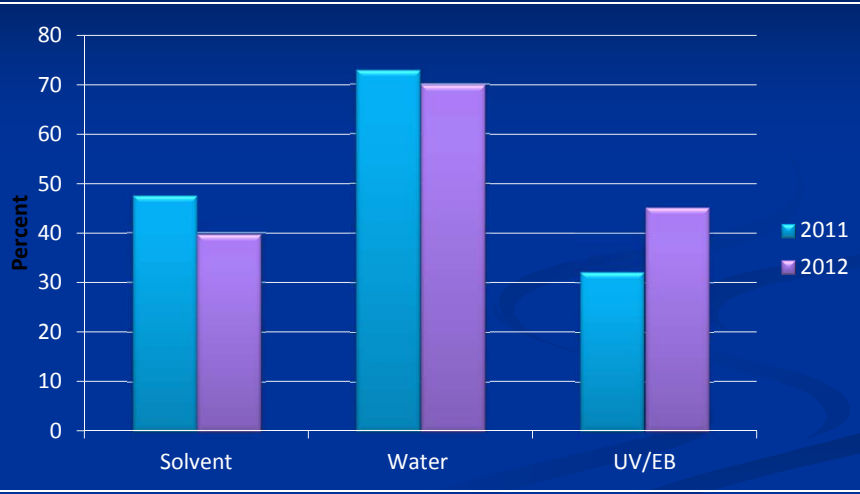
Ink Systems
Flexography



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FTA, 2012

UV/EB Technologies in Printing

- In 2012, 15% of the $37B global market for analog equipment & supplies was UV/EB related = $5.5B
- Users report:
  - Fewer quality concerns
  - Increased productivity & turnaround time
  - Quantifiable production cost savings

PRIMIR, 2012

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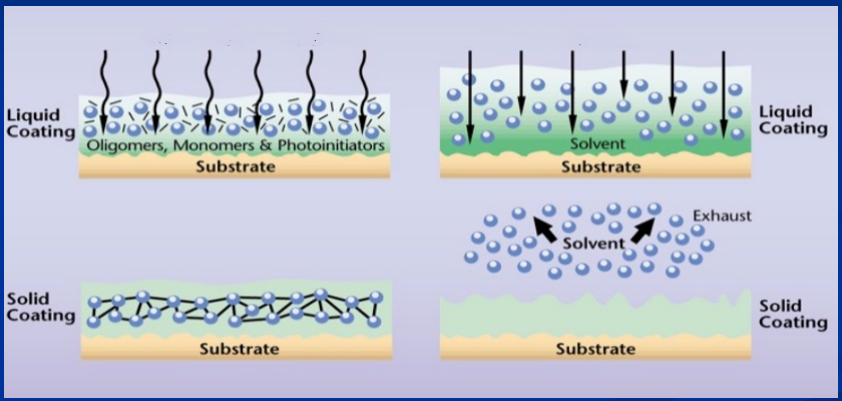
Energy Cured vs. Conventional



POLYMERIZATION

Liquid
- Monomers
- Oligomers
- Pigments
- Stabilizers
- Photoinitiators (UV)

Solid
- Polymers

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ULTRAVIOLET (UV)

Lisa Fine
Joules Angstrom UV Printing Inks

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UV Technology

- Photons - 3.5 eV (low energy)
- Photoinitiator needed
- Mercury lamps
- 250-450 nm Wavelength
- 100 - 500 mJ/cm^2 dosage required to cure
- Difficulty penetrating opaque, metallics & heavily printed substrates

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UV

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UV Curing on Press

- One or more UV lamps
- Means of dissipating heat from the lamps (ventilation)
- Shield to protect from UV exposure (integral to curing unit)

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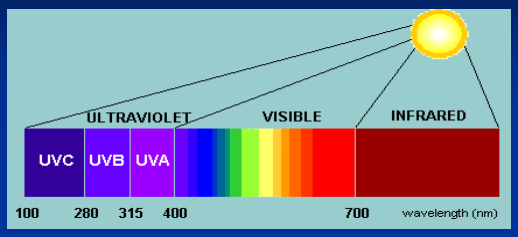
UV Ranges



- UVV: 400 nm and up (low end of visible range)
- UVA: 320 – 400 nm
- UVB: 280 – 320 nm
- UVC: 200 – 280 nm

UV Ranges (cont.)

- Short wavelength has higher energy but lower penetration, so is more involved in surface cure – UVB, UVC
- Longer wavelength has deeper penetration and so is involved in through (depth) cure – UVV, UVA

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First of all, technically – What is CURING?

- UV inks are comprised of oligomers + monomers + pigment + additives + photoinitiators
- The “curable” parts of the formula are the oligomers and monomers.
- Oligomers and monomers are not capable of curing quickly with just UV light alone
- Energy (in the form of UV light) strikes photoinitiators, in turn making them energetic
- Photoinitiators are energized by absorbing the light…and absorb light optimally at certain UV wavelengths…so lamp must output the right wavelength at an acceptable intensity to energize the photoinitiator

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WHAT IS CURING? (CONTINUED)

- This energy, in turn, is transferred to oligomer and monomer molecules, making them energetic
- It doesn't go on forever – eventually, the energetic species COMBINE and crosslink
- This, essentially, is what curing is – the crosslinking part of the process!

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OPERATIONAL BENEFITS OF UV

- Flexibility
- High Print Qualities
- Durability
- Fast Curing Speeds

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Electron Beam
EB

Steve Lapin
PCT Engineered Systems

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EB Technology

- Electrons - 70,000 eV to 300,000 eV (much higher energy compared to UV)
- No photoinitiator
- Filaments in a Vacuum Chamber
- 3 Mrad typical cure dose
  - 150 mJ/cm^2 for 50 micron layer (comparable to UV)

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WHY DON'T EB INKS NEED PI?

Electrons are far more energetic than UV light and can induce radical formation of ink components (monomers and oligomers) directly without the additional "help" provided by photoinitiators!

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EB CURING ON PRESS

- One EB unit per press
- Nitrogen "blanket" for proper surface curing
- Shield to protect from secondary x-ray exposure (integral to curing unit)
- Most common on web offset presses
- Flexo inks being developed

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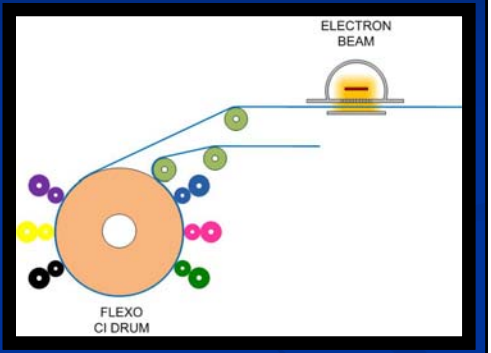
EB

Low voltage EB system
on web offset press



EB Flexographic Printing

Operational Benefits of EB

- UV Benefits plus:
- "Color Blind" – cures pigmented or clear materials
- Cool Process
- Low Power Consumption
- Stable Output

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Comparison & Benefits

UV/EB Curing System Benefits

- No/low VOCs, HAPs, GHGs
- Pollution control not needed
- Reductions in energy demand & emissions
- Eliminates need for explosion proofing

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Traditional Systems

- Energy
  - Heat large volumes of air/substrate
  - Maintain the oven at temperature
  - Evaporate and remove water/solvent
- Oxidizers for solvents (regulatory requirement)
- Greenhouse gas (GHG) emissions - fuel for oxidizers & combustion of solvents

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Solvent vs. UV/EB

	Solvent	UV/EB
Explosive Vapor	Common	None
VOCs	Yes	No/Low
HAPs	Yes/No	No
Energy Use	High	Low

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South Coast AQMD

- Qualify as a Super Compliant Material
  - Any material containing 50 grams or less of VOC per liter of material.
- The provisions of Rule 109 Recordkeeping for Volatile Organic Compound Emissions shall not apply to any Super Compliant Material(s) used at a facility which can demonstrate that the total permitted and non-permitted facility VOC emissions, including emissions from the super compliant material, do not exceed 4 tons in any calendar year as shown by annual VOC records.
- Rule 1130 Graphic Arts recognizes Rule 109

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UV/EB Safety Advantages

- Low acute systemic toxicity
- Low chronic toxicity
- No flammability hazard

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SAFETY

UV

- Intense UV radiation can cause skin/eye damage – shielding used to minimize exposure
- UV lamps operate at high temperature
- Uncured product can cause irritation and sensitization
- Photoinitiators can present a migration concern

EB

- Secondary x-rays generated when electrons interact with matter – shielded design blocks exposure
- Radiation Safety Officer
- Uncured product can cause irritation and sensitization

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UV/EB

- Generally not regulated by Department of Transportation (DOT) as
  - Flammable
  - Corrosive
  - Toxic
- Generally not defined as hazardous waste
  - Disposed of properly in accordance with regulations
- Not included in most federal or state Right-to-Know lists – can contain components on CA Prop 65

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UV/EB TECHNOLOGY SUMMARY

- Reduction in
  - Energy use
  - GHG emissions
  - VOC & HAP emissions
  - Permit fees
- Regulatory Relief
- Safe workplace
- Positive performance advantages and economic returns (speed of cure, end product)

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ADDITIONAL INFORMATION

- *RadTech Report*
- Recording of webinar
- Follow-up survey
- Email presenters

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2012 Student Poster Competition Awards
TAGA, the Technical Association of the Graphic Arts and RadTech once again teamed up to ask students to create a poster design to showcase areas where UV and EB materials are used and to highlight the benefits of the technology.
Read the Full Story
Search RadTech
GO
Why just read the story of the emerging radiation curing field when you can help write it?
Lead the green technology movement with our online Radiation Curing Program.
Learn more here.
ESF
RadTech Meetings/Events
Check out our latest Webinars
RadTech Annual Winter Meeting
February 27-28, 2014 Miami
Co-Located with Graphics of the Americas
RadTech 2014
May 12-14, 2014
View full calendar
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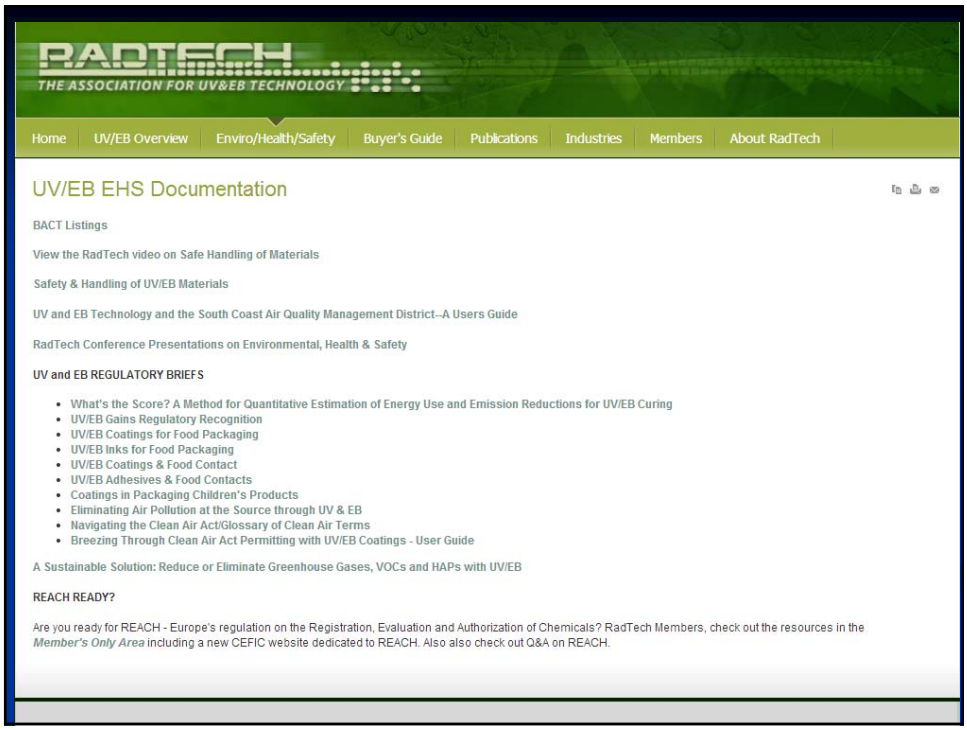
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Safety & Handling of UV/EB Materials
UV and EB Technology and the South Coast Air Quality Management District--A Users Guide
RadTech Conference Presentations on Environmental, Health & Safety
UV and EB REGULATORY BRIEFS
What's the Score? A Method for Quantitative Estimation of Energy Use and Emission Reductions for UV/EB Curing
UV/EB Gains Regulatory Recognition
UV/EB Coatings for Food Packaging
UV/EB Inks for Food Packaging
UV/EB Coatings & Food Contact
UV/EB Adhesives & Food Contacts
Coatings in Packaging Children's Products
Eliminating Air Pollution at the Source through UV & EB
Navigating the Clean Air Act/Glossary of Clean Air Terms
Breezing Through Clean Air Act Permitting with UV/EB Coatings - User Guide
A Sustainable Solution: Reduce or Eliminate Greenhouse Gases, VOCs and HAPs with UV/EB
REACH READY?
Are you ready for REACH - Europe's regulation on the Registration, Evaluation and Authorization of Chemicals? RadTech Members, check out the resources in the Member's Only Area including a new CEFIC website dedicated to REACH. Also also check out Q&A on REACH.

RADTECH UV&EB 2014

May 12-14, 2014

Hyatt Regency O'Hare
Rosemont/Chicago, IL

www.RadTech.com

QUESTIONS?

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