

# Applying EB-Flexo ink technologies to the Food Packaging Industry

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## About PepsiCo

- Leading food & beverage company
- *Performance With Purpose*
- \$66 billion+ annual revenue
- 250,000 employees
- 22 billion-dollar brands
- 200+ countries
- HQ - Purchase, NY
- *Fortune 100* & “Most Admired” company

# Broad Food & Beverage Portfolio

## 22 Billion-Dollar Brands



## More Than 40 \$250 Million–\$1 Billion Brands



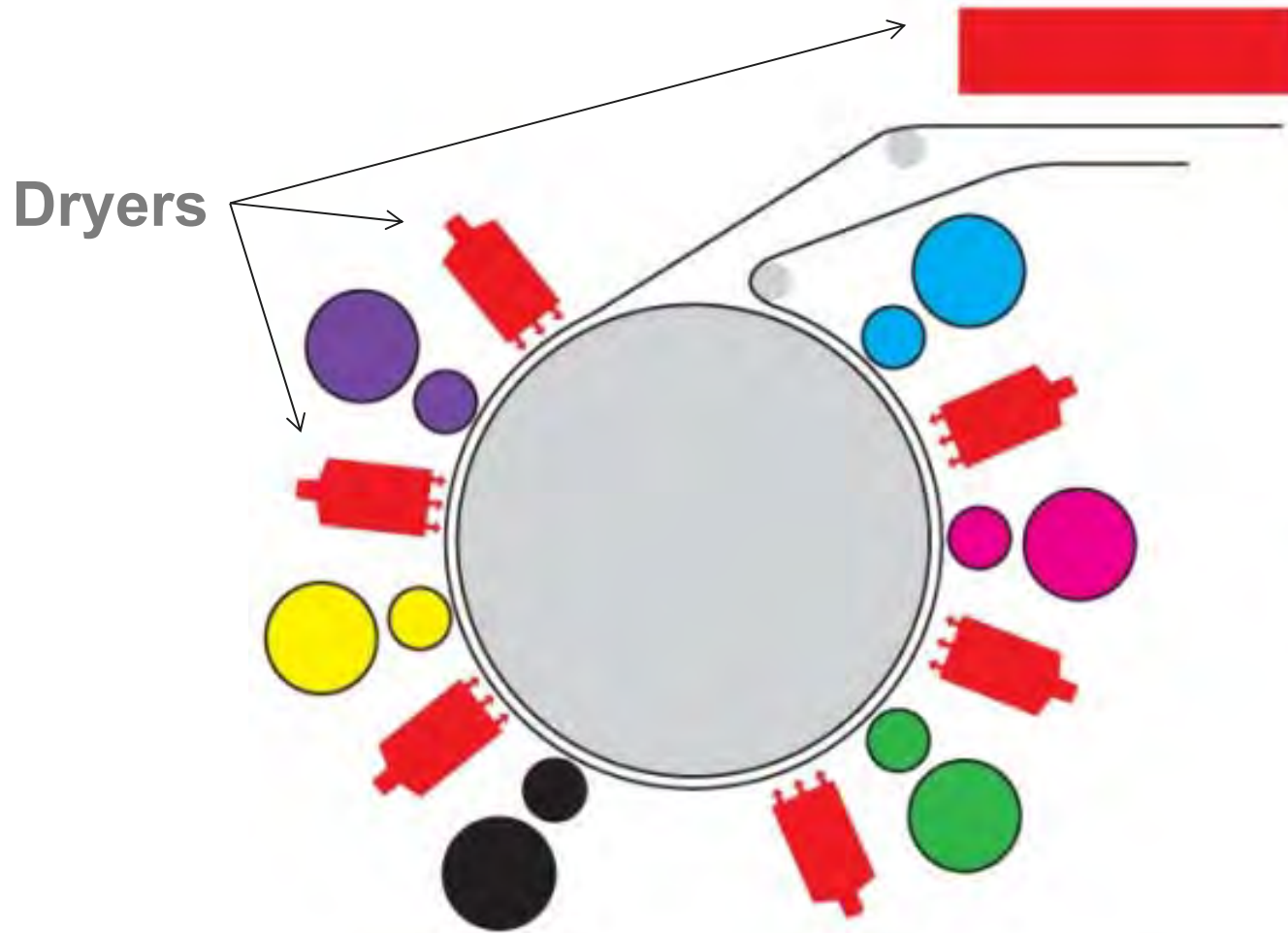
# The State of CPG Economics

- Flat category growth fuels battle for market share
- Private label competition drives need to differentiate
- NA profit growth relying on downward pressure on fixed costs
- Int'l growth in BRICS challenged by high packaging/distribution costs

# Obvious Productivity is Losing Steam

- Flat category growth fuels battle for market share
  - Private label competition drives need to differentiate
  - NA profit growth relying on downward pressure on fixed costs
  - Int'l growth in BRICS challenged by high packaging/distribution costs
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- Wider and faster have diminishing rates of return
  - Down-gauging impacts quality and consumer impression
  - Barrier films are approaching commodity pricing

# Conventional Flexo Printing Requires Drying



# What is GelFlex EB?

- Majority is EB chemistry
  - Pigment
  - Oligomer
  - Additive
- Small amount of non-reactive resin dissolved in solvent
- Inks gel when:
  - Shear energy is removed
  - Solubility of non-reactive resin is changed (solvent evaporation)
- Gel provides “wet trap”
- Full chemical and physical resistance occurs when EB cured
- Best print quality with solvent (<15%)
  - Can be done solvent-free
  - Best gel occurs with solvent



Photo c/o Siegwirk Druckfarben AG & Co.

**GelFlex EB “GEL”**

# What are conventional flexo inks made of?

## Common components

- **Pigment**
  - Color
  - Fade, weather resistance
- **Additives**
  - Enhance physical properties
  - Solubilize ink components
- **Resins**
  - Supports and delivers pigment
  - Print properties
  - Adhesion
  - Resistance properties

## Solvent Base

- **Solvents**
  - Dissolve ink components
  - Lower viscosity
  - Adjust drying speed

## Water Base

- **Water**
  - Lower viscosity
- **Organic amines**
  - Solubilize ink components



# How are EB Inks Different?

## Common components

- **Pigment**
  - Color
  - Fade, weather resistance
- **Additives**
  - Enhance physical properties

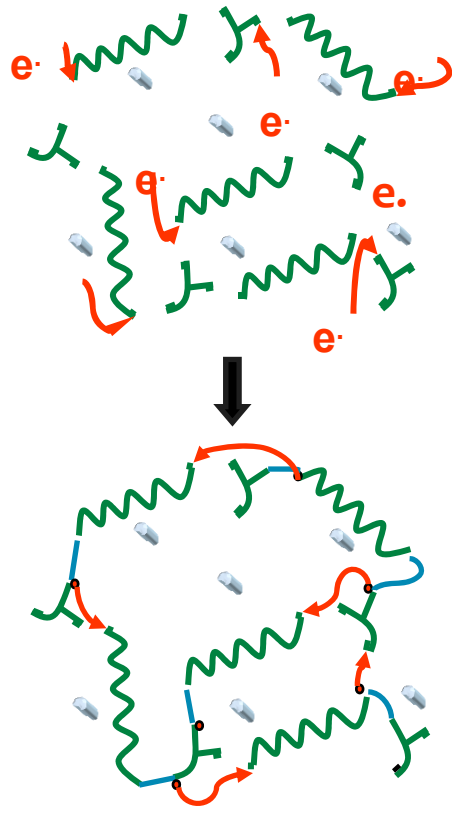
## Solvent Base

- **Resins**
  - Supports and delivers pigment
  - Print properties
  - Adhesion
  - Resistance properties
- **Solvents**
  - Dissolve ink components
  - Lower viscosity
  - Adjust drying speed

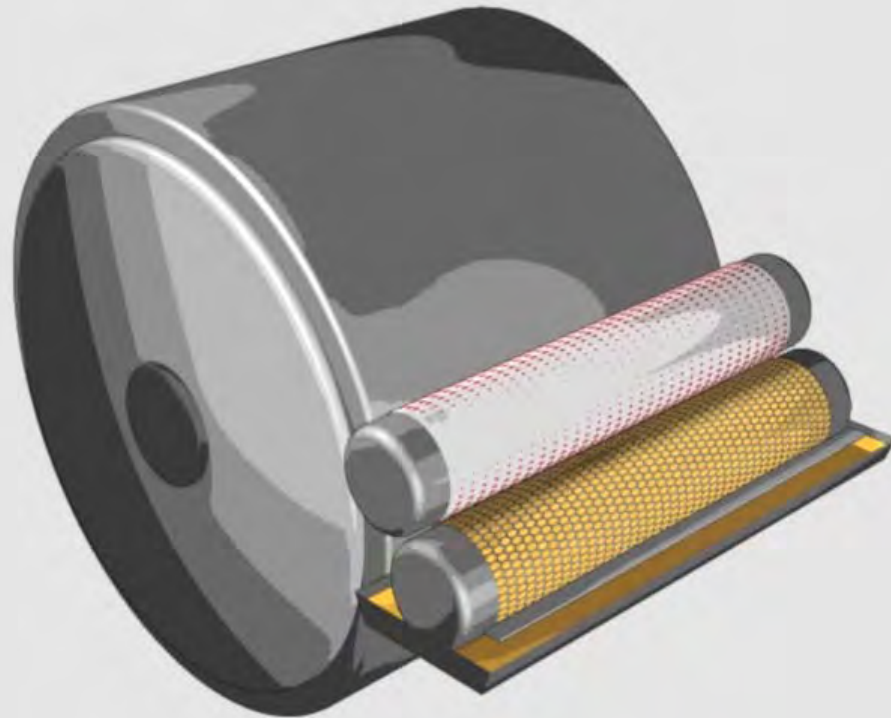
## Flexo EB

- **Oligomers**
  - Supports and delivers pigment
  - Print properties
  - Adhesion
  - Resistance properties
- **Monomers**
  - Lower viscosity
  - Adjust cure speed

# Cure Mechanism Induced by Electrons

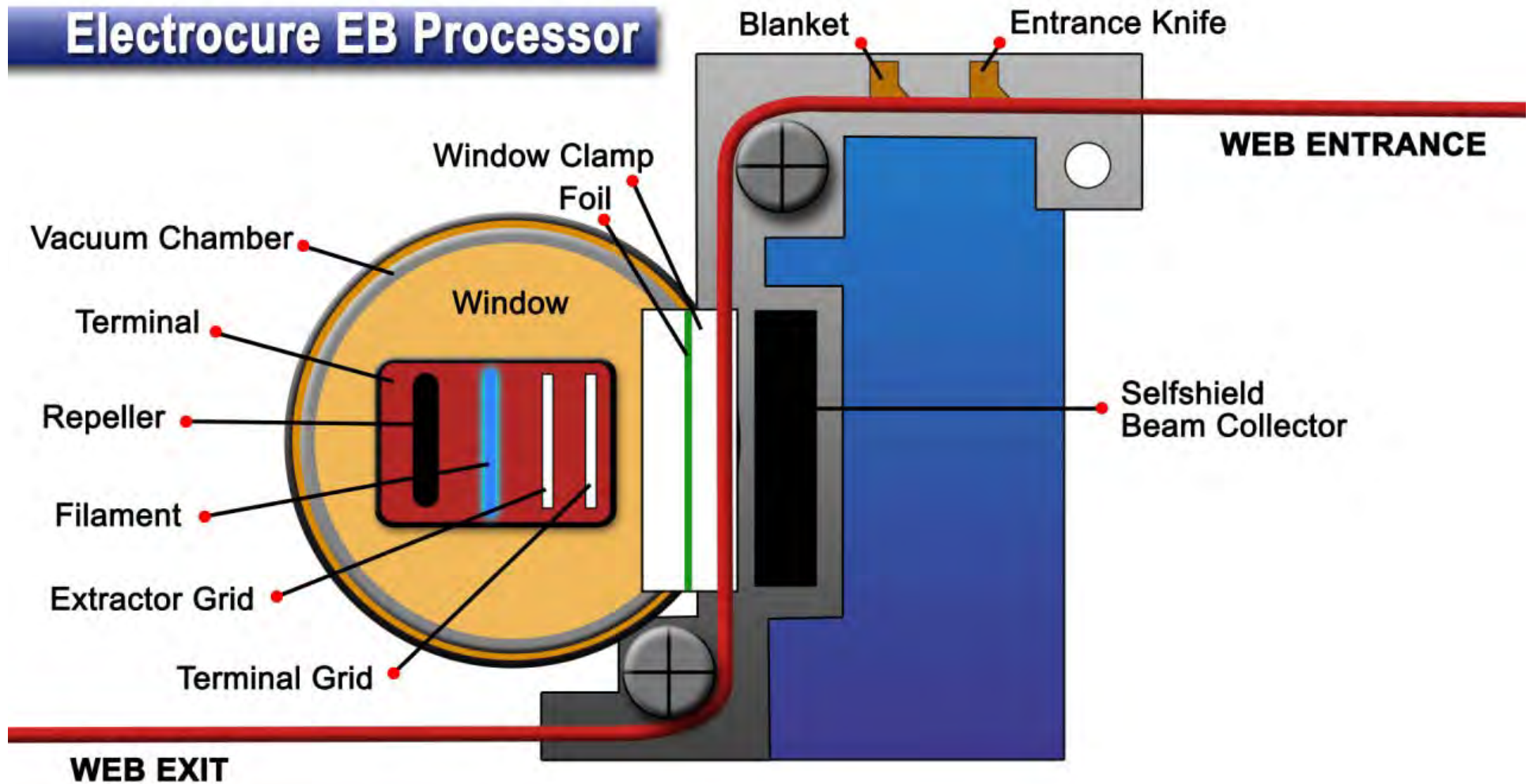


# GelFlex EB Printing



# Cure Mechanism Induced by Electrons

## Electrocure EB Processor



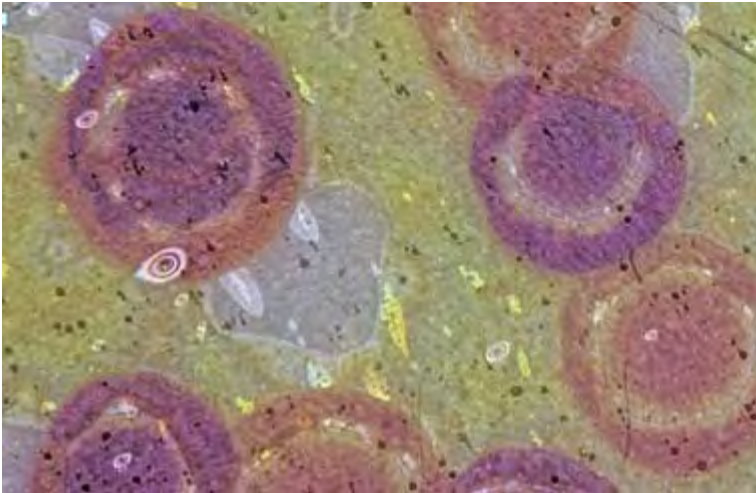
# GelFlex EB Advantages

- Standard flexo presses
  - Single downstream EB unit
- Eliminates the need for multiple UV curing stations vs UV flexo
- Excellent print quality
- Large reduction in VOC vs traditional solvent flexo
- Very low energy required to cure
- Absolute optical control (gloss/COF)
- Both surface and laminated structures
- Great dot gain

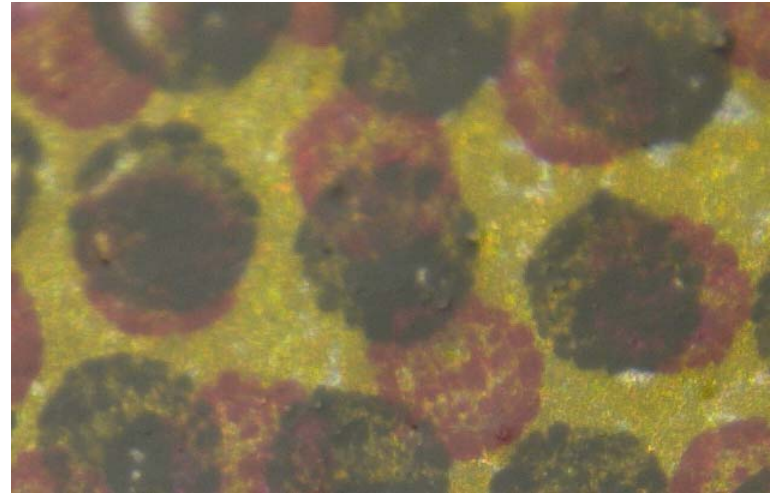


## Dot gain at 250X

Standard Solvent-based



Gelflex EB



# Comparison of Coating Technologies

## Water Based versus Solvent Free EB

- Gloss Finish Solvent Free EB Coating
  - Good Gloss
  - Lower Static & Kinetic COF
  - Superior Rub Resistance

Product:	Gloss Water Based Coating	Solvent Free EB Coating
60° Gloss:	50 - 70	65.0 – 75.0
COF Static:	0.737	0.351
COF Kinetic:	0.584	0.319
50 Double Rubs: (Southerland 4 lb)	7.0 Ink Smear	10.0
100 Double Rubs: (Southerland 4 lb)	7.0 Ink Smear	9.5

# Comparison of Coating Technologies

## Water Based and Solvent Based versus Solvent Free EB

- Matte Finish Solvent Free EB Coating
  - Low Gloss
  - Low Static & Kinetic COF
  - Superior Rub Resistance

Product:	Matte Water Based Coating	Matte Solvent Based Coating	Solvent Free EB Coating
60° Gloss:	5	15.7	7.9
COF Static:	0.505	0.251	0.424
COF Kinetic:	0.396	0.201	0.302
50 Double Rubs: (Southerland 4 lb)	9.5 Scratches	9.0 Very Subtle gloss polishing	10.0
100 Double Rubs: (Southerland 4 lb)	7.0 Ink Smear	7.5 Subtle gloss polishing over large areas	10.0



# Comparison of Matte Coatings

## 100 Double Rubs



Ink smear of  
water based



Scratches and polishing  
of solvent based



Rub resistance  
of solvent free EB

# Formulation and Process Considerations For Solvent Free EB Cure Coatings

- **Conditions that Impact Gloss Finish**

- Inherent gloss of acrylate resins (clarity, compatibility, flow)
- Compatibility of additives (slip agents, degassing aids, etc)
- Porosity and surface roughness of films and inks to be coated
- Coating process (thicker and smoother is better)
  - Minimize air entrainment

- **Conditions that Impact Matte Finish**

- Light scattering properties of acrylate resins and additives
- Completeness of dispersing any matting agents
- Surface roughness of films and inks to be coated
- Coating process (thinner and rougher is better)

- **Finding Optimal Coating Conditions**

- Varies by specific formulation
- Anilox volume, angle, and pattern
- Anilox cell shape
- A banded roll is helpful!



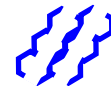
60°



45°



30°



Trihelic



YAG



CO2



XLT

Drawings c/o Henkel AG & Co.

# EB Technology Enables the Next Generation of Flexible Packaging

- The durability of EB coatings enable surface printing
  - EB performance far surpasses conventional lacquers
- Surface printing yields a dual advantage
  - Using lower cost films as print web (productivity)
  - Controls surface optics (product differentiation)
- Gelflex requires much less energy to cure and much lower VOCs
- Gelflex has much improved laydown over conventional inks

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