

# UV/EB Curable PSA's

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# PSA Technology

- Solution
- Emulsion
- Hot Melt
- Radiation Cure
  - UV/EB Hot Melt
  - UV/EB Liquid Systems

# UV/EB vs. Conventional PSA's

- Solution, Emulsion, Hot Melt
  - High molecular weight well characterized polymers – no chemical change upon application
- UV/EB Hot Melt
  - High molecular weight polymer – crosslinked upon cure
- UV/EB Liquid Systems
  - Monomer, oligomers, tackifiers
  - High molecular polymer formed upon cure
  - Properties are highly dependant on cure

# Advantages of UV/EB Curable Pressure Sensitive Adhesives

- Hot melt products offer high performance
  - Heat resistance (SAFT)
  - Solvent/chemical/water resistance
  - UV stability
  - Stable peel
  - Properties approach solvent acrylic PSA's
- Low viscosity products offer application advantages
  - Easily incorporated into a wide variety of processes
  - Instant curing

# Other Advantages of UV/EB Curable PSA's

- Environmental
  - Low VOC's, low HAP's, reduced reporting, low flammability
- Economic
  - Lower capital cost vs. thermal dry systems, low energy use, floor-space savings
- Processing
  - High line speeds, heat-sensitive substrates, pattern application

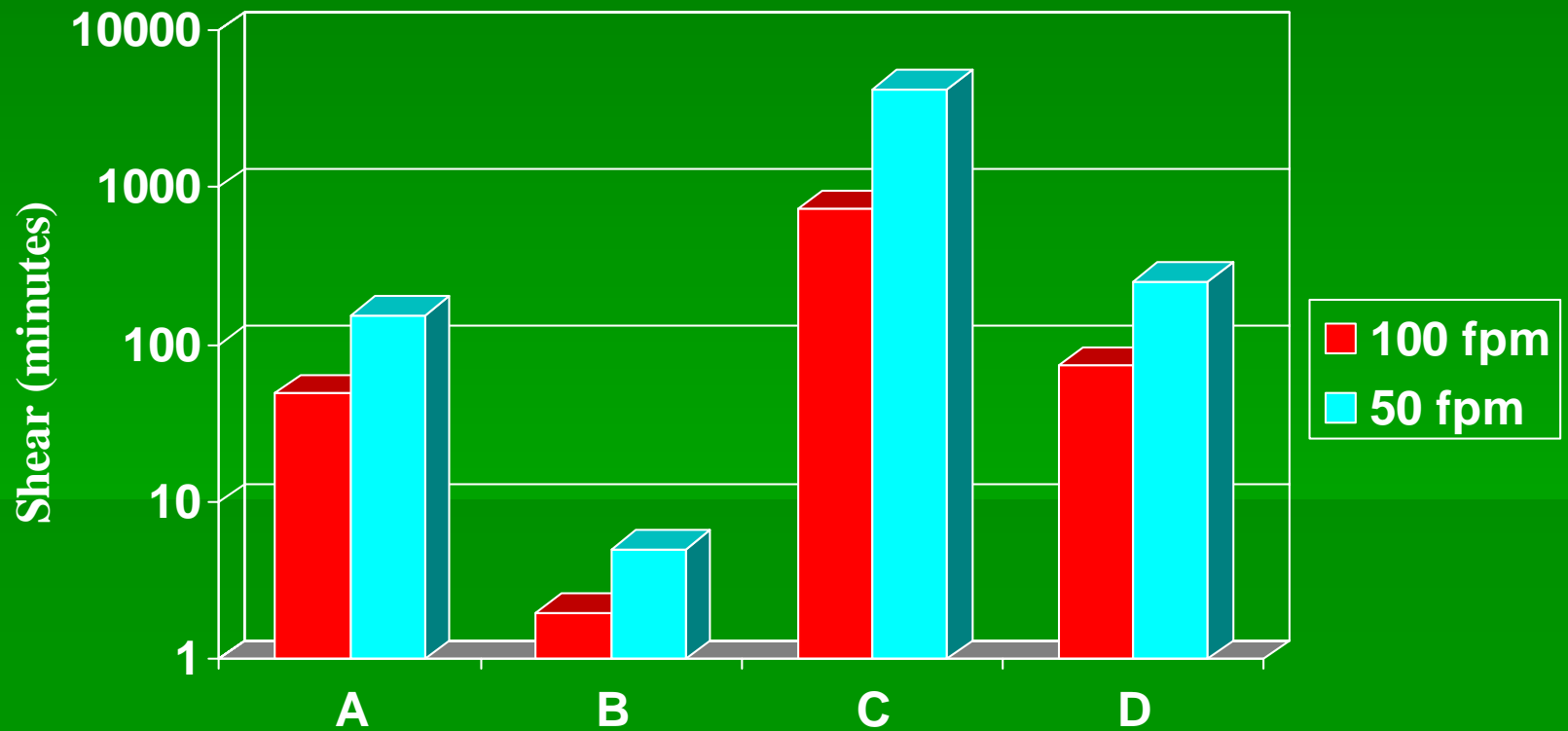
# UV/EB Liquid PSA Systems: Technical Status

- Viscosity as low as about 750 cps at room temperature
- UV cure 100 fpm per 400 w/in lamp
- Low odor
- Properties ranging from permanent to removable
- Aging properties not well characterized
- Relatively high cost
- Several commercial specialty applications – narrow web tape, label, and business forms

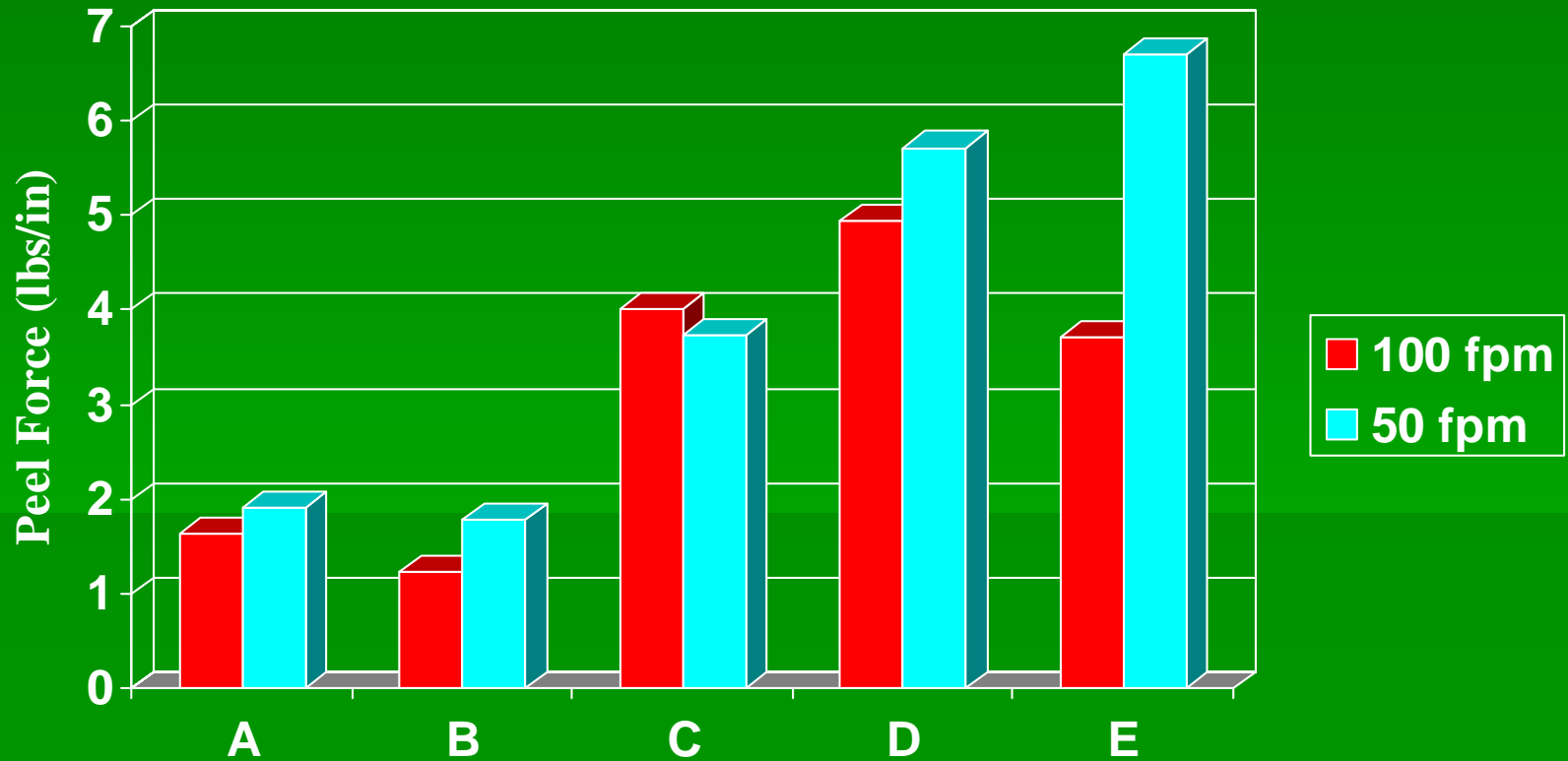
# Typical UV Liquid PSA's

	A	B	C	D	E
Viscosity (cps @ 25°C)	950	2000	2000	3300	7600
Peel (lbs/in, 180° on ss)	1.92	1.79	3.73	5.71	6.70
Tack (lbs/in)	4.95	7.09	2.08	5.51	4.95
Shear (min @ 25°C)	154	5	4260	253	>10000

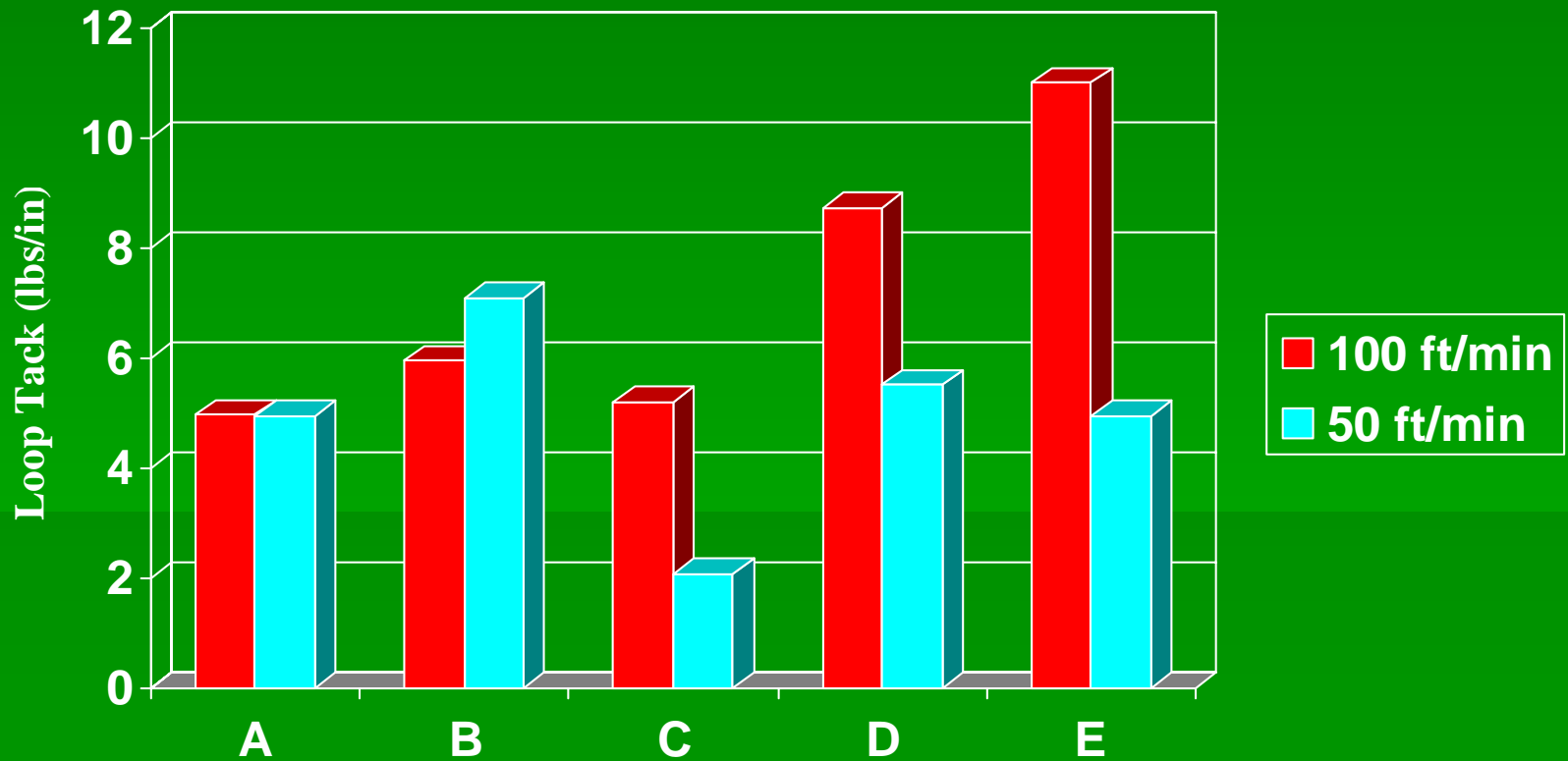
# Effect of Cure on Shear Properties



# Effect of Cure on Peel Strength



# Effect of Cure on Tack Properties



# Why Use UV PSAs for Narrow Web Label Applications?

- UV Adhesive may be applied with existing press station
- Most flexo presses are already equipped with at least one UV lamp
- Little additional capital costs
- Fast change-over for PSA use
- Pattern application with conventional flexo plate

# Narrow Web Application of PSA's: Disadvantages of Other Technologies

- Water Based
  - Difficult to dry > 1.0 mil wet film thickness
  - Difficult to maintain consistency upon starting and stopping and under different humidity conditions
  - Difficult clean-up
- Solvent Based
  - Solvent emissions
  - Flammability concerns
- Hot Melt (slot die or heated print system)
  - New equipment required
  - Pattern changes can be difficult and costly

# Label Applications for UV PSA's

## Two Main Types of Applications:

- In-line application as an alternative to conventional PS label stock
- Pattern application for specialty label constructions - Often used together with conventional PS label stock

# In-line Application of UV PSA and UV Release

## **ADVANTAGES:**

- Potential cost savings compared to purchased label stock
- Additional cost savings by pattern application
- Waste without adhesive or release may be recycled (DAS Systems)
- Can use existing press equipment with little modification (Easy change of plates, anilox screens, etc)

# In-line Application of UV PSA and UV Release

## **DISADVANTAGES:**

- Narrow web printing industry does not typically have controls in place to ensure consistent performance of adhesives and release coatings
- Adhesive or release failures become the printers responsibility
- UV PSA performance properties are not as well developed as conventional label adhesives
- FDA compliant UV PSA's are not yet available
- Extra print stations for UV PSA and release application may not be available

# Specialty Applications for UV PSA's

- Business forms
- Direct mail
- Cold foil transfer
- Inserts and pouches
- Expanded information labels: piggy back, booklet and coupon constructions

# Specialty Applications for UV PSA's

- Application of adhesive over printed areas
- “Back label” construction
- Window labels
- Printed self-wound tapes
- Pattern application for unique containers
- Security/tamper resistant constructions

# Cold Foil Transfer With UV Adhesives

- Saves more than 90% of the set-up time and cost of hot foil stamping
- Pattern is defined by a flexo plate rather than a hot stamping die
- PSA Type:
  - Apply UV adhesive and cure to a tacky state
  - Nip foil to the adhesive
  - Strip away carrier film and excess foil
- Through Cure Type:
  - Apply UV adhesive
  - Nip foil to the wet adhesive
  - UV cure through the foil
  - Strip away carrier film and excess foil

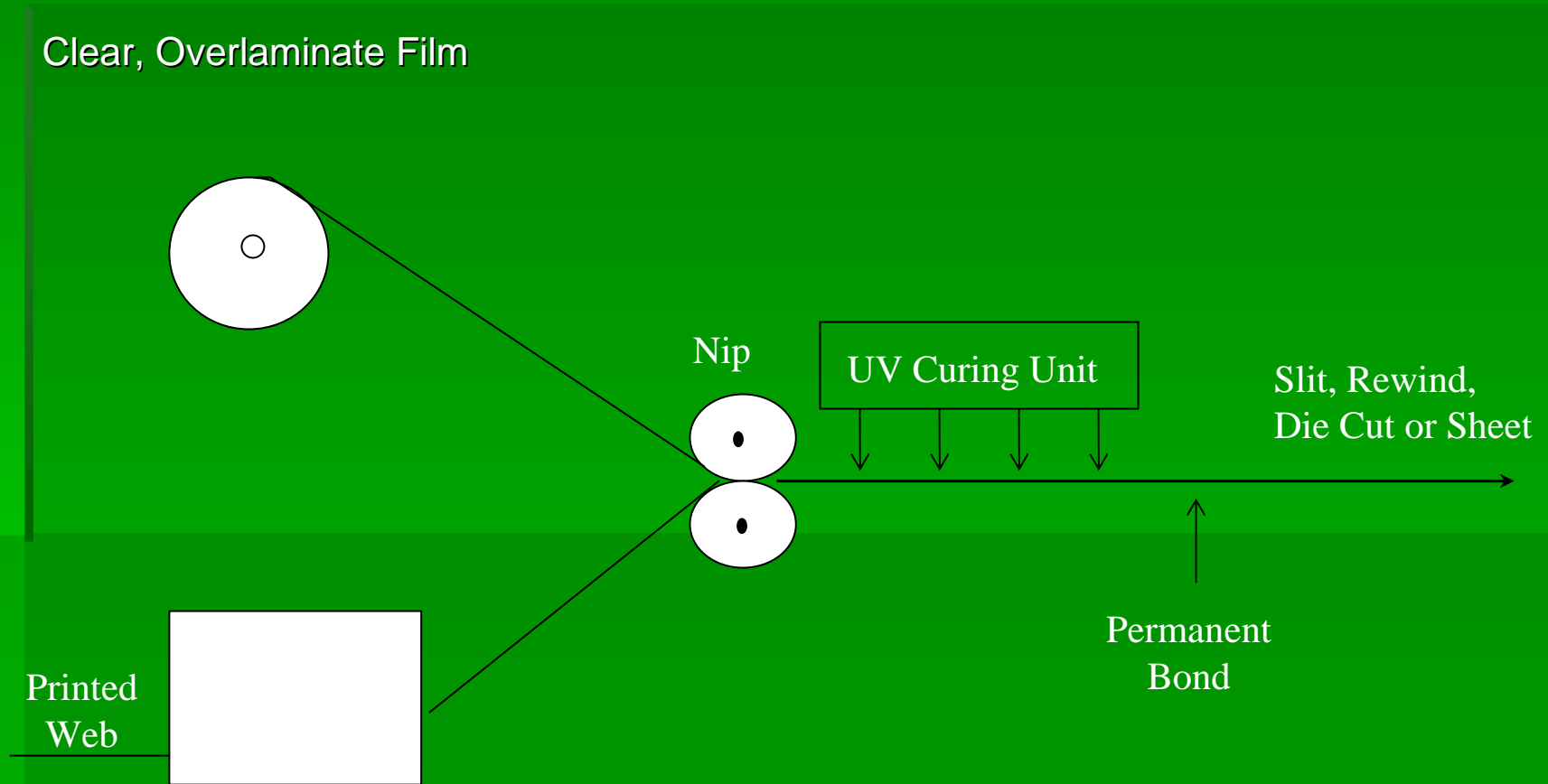
# Laminating With UV/EB Adhesives

- Laminating adhesives are designed to provide a permanent bond between two webs
- Three main types of UV laminating:
  - UV laminating adhesives
  - UV pressure sensitive laminating adhesive
  - UV cure, thermal post cure
- EB laminating
  - EB can penetrate printed or opaque substrates
  - No photoinitiator or nitrogen inerting required
  - Flexible packaging applications

# UV Laminating Adhesives

- Process (wet bond lamination)
  - Adhesive applied to base web or clear film
  - Nip films together
  - UV cure through clear film
- Limited to clear films with good UV light transmission (oPP most common)
- Cured adhesive is usually dry and tack-free
- Commonly applied in-line with printing on the base web
- Widely used for the lamination of pressure sensitive and glue applied labels

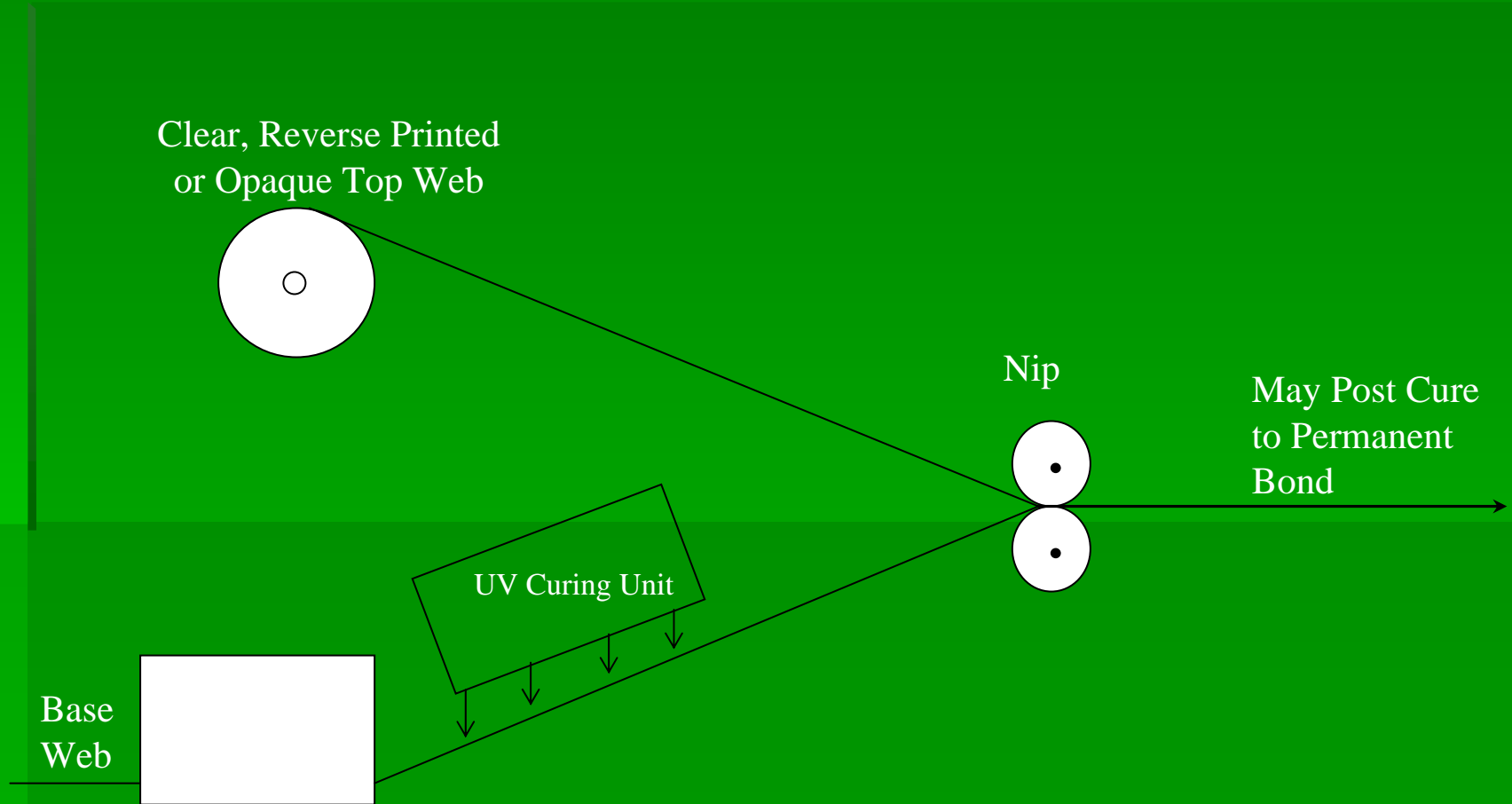
# UV Laminating Adhesives



# UV Pressure Sensitive Laminating Adhesives

- Process (dry bond lamination)
  - Apply liquid adhesive to base web or top web
  - UV cure to provide tacky properties
  - Nip webs together
- Not limited clear films – opaque substrates or reverse printed films may be laminated
- Adhesive usually remains tacky after cure
- Post curing adhesives may also be used
- Can provide bond strength superior to UV laminating adhesives for some substrates

# Laminating With UV Pressure Sensitive Adhesives



# Conclusions

## Liquid UV/EB Curable PSA's

- Liquid UV/EB curable PSA's are available with a wide range of properties
- Adhesive properties depend on the degree of cure
- Interest has been driven by application advantages rather than performance
- Technology is well suited to specialty applications
- Technology is also well suited for laminating applications