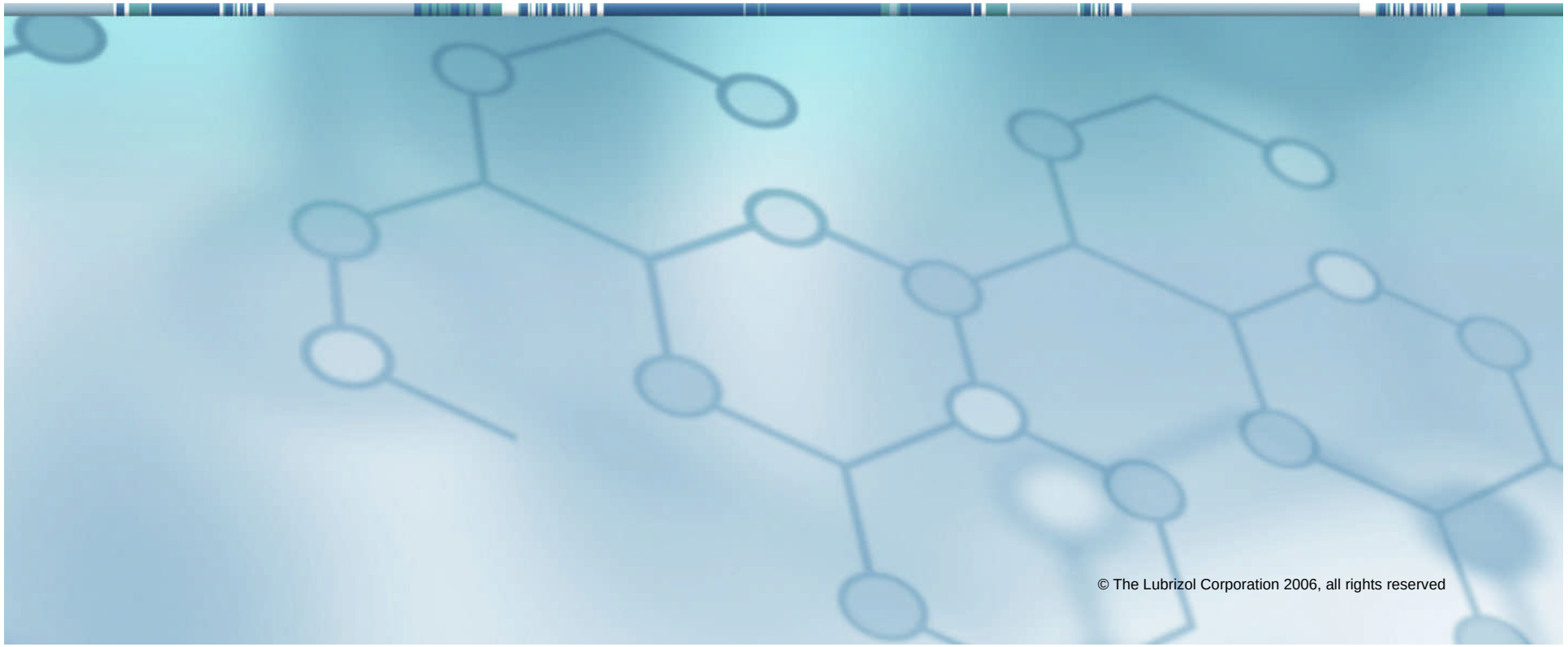
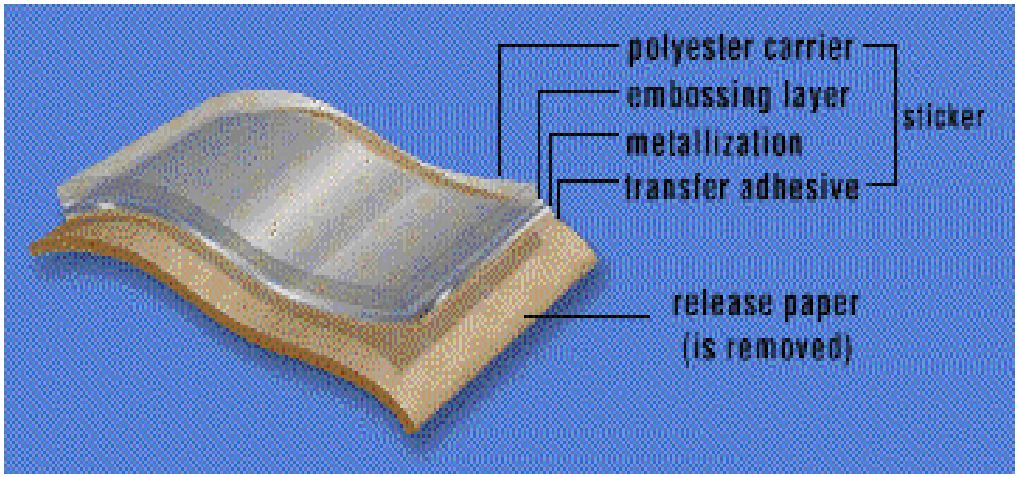
noveon

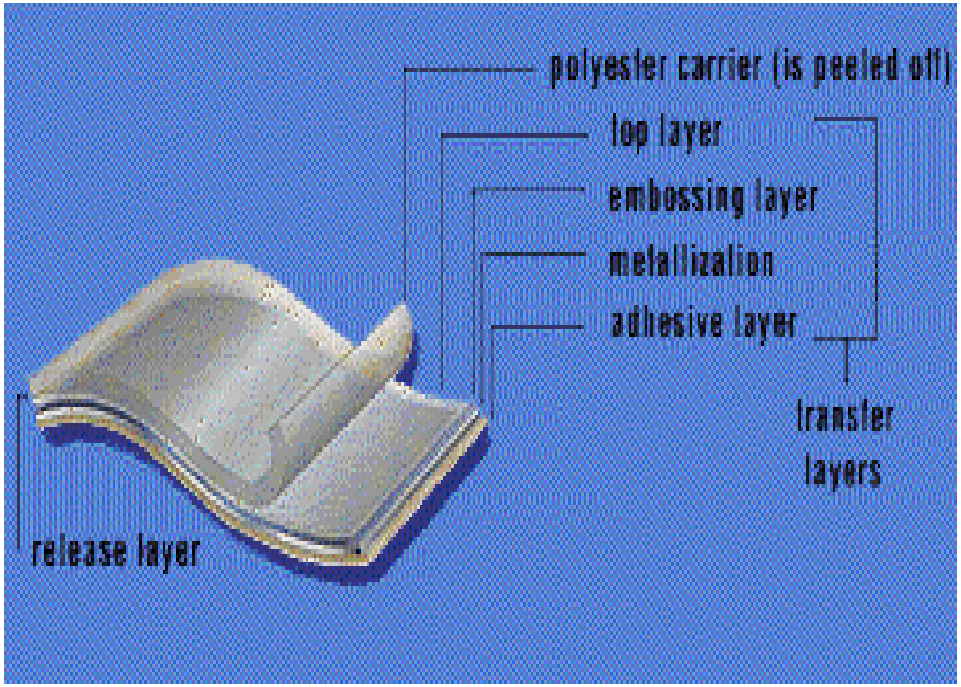
HOT STAMPING FOIL



What is HSF?

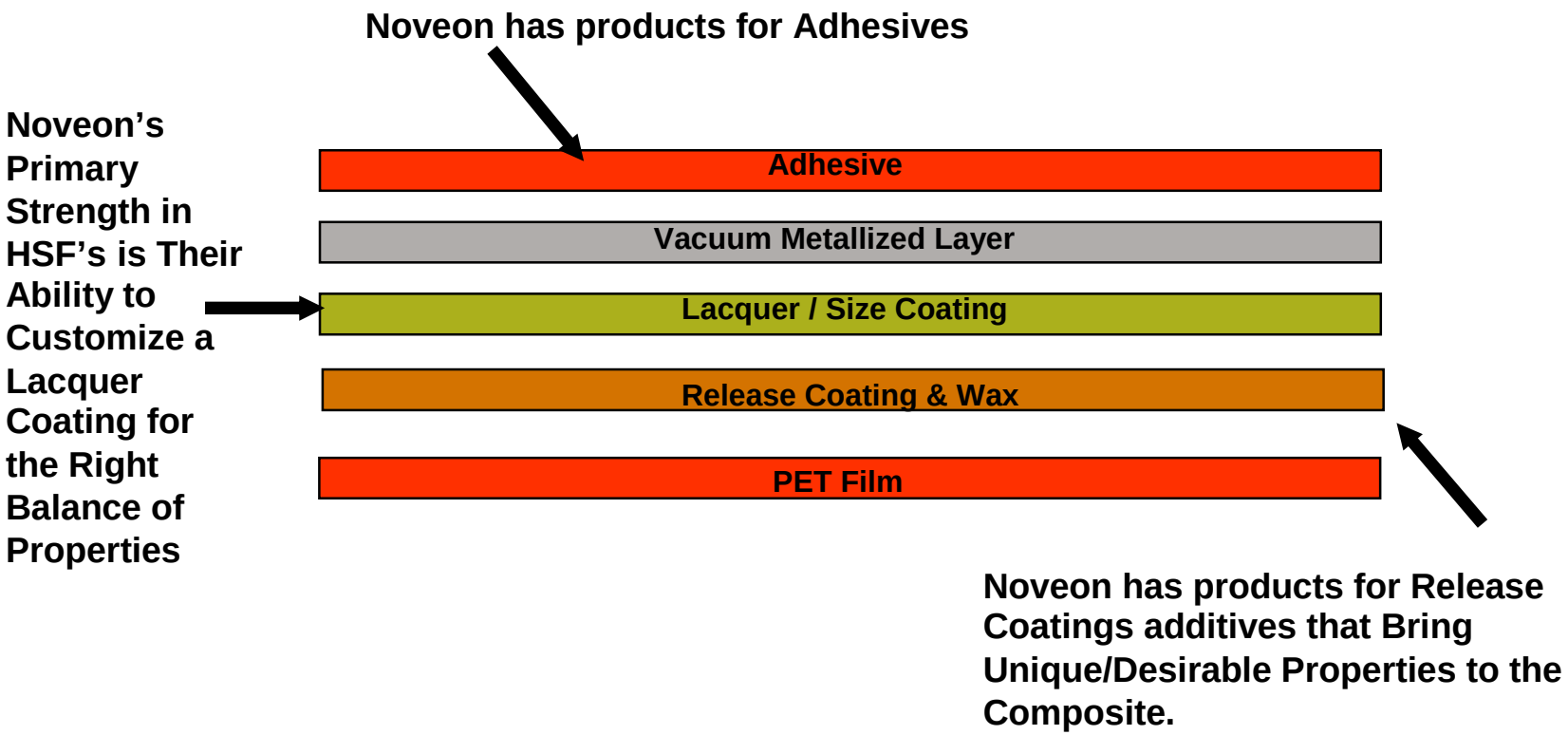
Self adhesive Holographic label





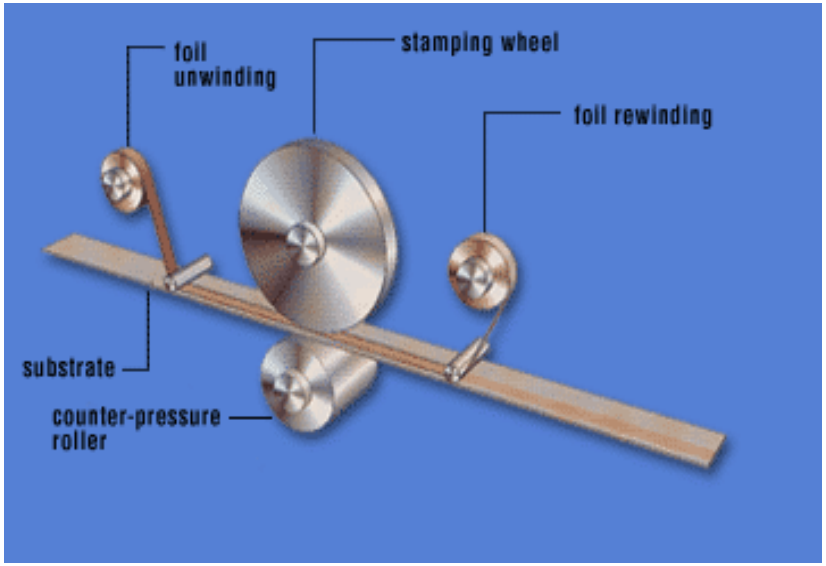
Standard HSF Structure

Hot Stamp Foil – Simplified View

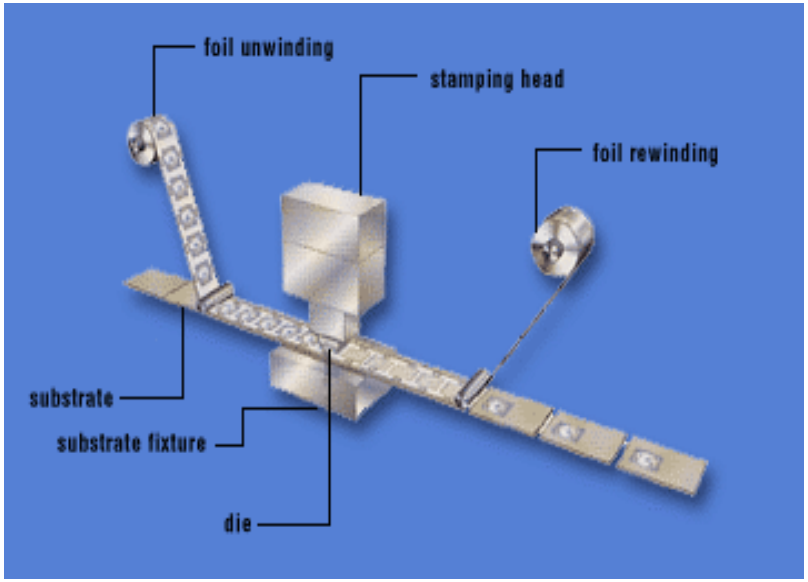


Stamping Process for HSF

Roll on stamping



Up and Down Stamping



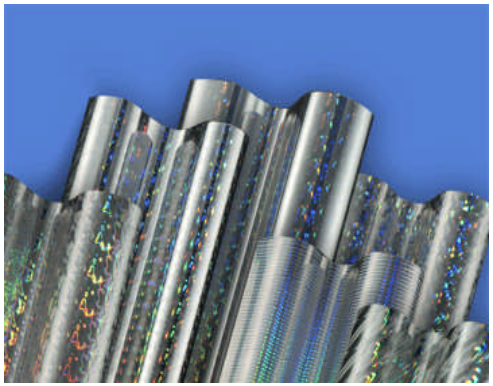
Hot Stamping Foil

- Base film is generally PET or could be other types of plastics eg vinyl, PC, PP or PE. The films is normally Corona treated to improve surface energy (40-50 dynes)
- 1st Coat is the release coating (wax or a blend of wax and acrylics)
- 2nd Coat is the size coatings. This is the most critical coat. For HSF, the patterns are “stamped” on to the lacquer coat.
- Stamping or Embossing
- There are different methods of embossing
  - Hot embossing will result in deeper and more impressive impression on the lacquer coat. Temperature ranges from 140-180 deg C.
  - Cold embossing – for polyester films or films that is already metallized Based
  - Hard embossing – where high pressure is applied, roller is made of metal eg nickel and used for diffractional or holographic patterns
  - Soft embossing – where lower pressure is applied, roller is made of plastics and used for smooth or general patterns
- The stamped or embossed coat is then metallized – usually with aluminium via vacuum metallising for an even metallic coat.
- The final 3rd coat of adhesive is coated over the metallised film to act as an adhesive and also to protect the metallised surface from abrasion, corrosion and oxidation

Hot Stamping Foil

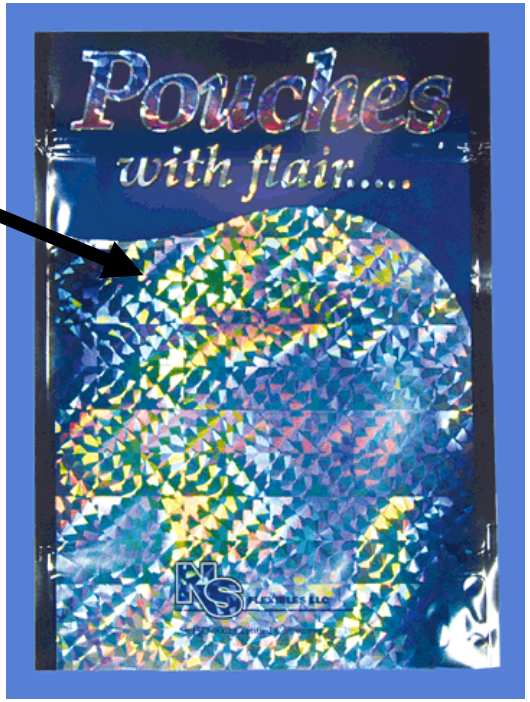
Market Segments

- Traditional HSF non off line embossing
- Traditional HSF for off line embossing
- Hologram HSF (Non security applications)
- Hologram Brand Protection



Hologram HSF (Non security applications)

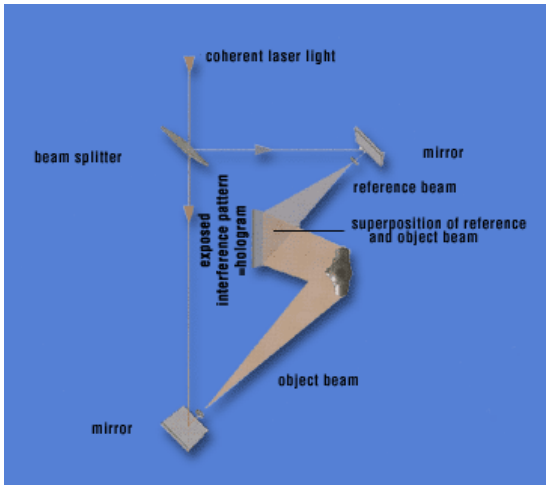
- The layer that will be metalized is embossed on the film in a printing like process in the desired pattern



- For an Hologram on paper traditional hot stamping technology is used. The Size coating is embossed and then metallized.

Hologram Brand Protection

- The process to manufacture the security holograms is different.
- A MASTER is produced which replicates and embosses on the cylinder the designed pattern
- Thjis is then used for embossing the size coating produced under standard Hot Stamping foil process



Holograms: manufacturing

- **Manufacturing of a Hologram**
  To make a hologram, laser light is split into two different beams. One is reflected off of an object and then scatters to the film, while the other beam goes directly to the film. The two beams meet at the film causing an interference pattern of microscopic bright and dark lines. The film captures this pattern, which is the hologram. Holograms are made using Precision Optical and special Photosensitive Materials, which are exposed with Laser Light. After the first Hologram is made in the Laboratory (Known as the MASTER), the Holographic Image can be copied repeatedly on a variety of formats, depending on the intended applications and required quantities.

- **Working of Holograms**
  When a Beam of Light strikes a Hologram at the proper angle, a Multi-dimensional Image will appear - Direct Sunlight or a Single Overhead Spotlight is the best way to illuminate Holograms with deep Imagery. Embossed Holograms, with their Shallower Imagery, can be viewed when lighting is less than ideal - under Fluorescent light etc.

Holographic Films

- Holographic films are very thin, flexible plastic film, which have been micro-embossed with a holographic image or pattern. The embossing process creates a pattern or an image which can provide a 3-D effect and spectral colouring. The embossing process is like cutting tiny grooves into the surface of the film at various angles and in different shapes. The micro-grooves cause the diffraction of regular white light into spectral colouring.

Hot Stamp Foil Applications Requirements

- **Key requirement is a good bond between each layer, the metallized layer and the adhesive layer**
- **For Identity**
  - **Packaging**
  - **Beverage**
  - **Printing**
  - **Cosmetics**

Need Wear, Chemical, Water Resistance

- **For Security**
  - **Credit Cards**
  - **Bank Notes**

Need Unique Embossing and Stamping Properties

Hot Stamping Foil

- Current Noveon product portfolio is Solvent Based
- WB is being explored although is not a market requirement yet
- Most products supplied from the US (Dock Resins)
- Some products are adapted to be suitable for Europe (solvent systems) and will be produced in Spain by end 2006
- Noveon products Leader in Coating Technology for High Index of Refraction Coatings targeted for Holographic HSF (hard embossing)
- Inventory for Asia are kept in Shanghai, China

Noveon Products for HSF

AC341 Series

- High Tg Thermoplastic Resin
- Differs from SA series by high Acid number and solvency
- Alcohol soluble
- AC-341-2
    - Tg = 138º
    - Embossable
- AC-341-7
    - Tg = 152º
    - Non embossable

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Noveon Products for HSF

SA24 Series

- High Tg Thermoplastic Resin
- SA-24-1
    - Tg = 125º
    - Embossable, heat resistant, brittle
- SA-24-15
    - Tg = 138º
- SA-24-16
    - Tg = 90º
- Toluene based

Products for HSF

AC347 Series

- High Tg Thermoplastic Resin
- AC-347-13
    - Tg = 125º
    - Embossable, heat resistant, brittle
- AC347-1
    - Tg = 138º
    - AC347-5 is a low MW version of AC347-1
- AC347-19
    - Tg = 90º
- Toluene based

Product Properties

Product	Viscosity	NVV	Solvent	Misc. in EtOH	Type	Tg °C	Application
AC 341-2	900 cps	45 %	MEK Ethanol	85-15	Dyestuff Compatible (E)	132	Lacquer/ Size Coating
AC341-7	1000 cps	45%	MEK Ethanol	85-15	Dyestuff Compatible Increased heat resistance (NE)	152	Lacquer/ Size Coating
AC347-1	Y (Gardner)	45%	Toluene		Ultra High Tg	138	Size Coating
AC347-13	Z4 (Gardner)	45%	Toluene		Ultra High Tg (E)	125	Size Coating
AC347-19	2000 cps	45%	Toluene		Embossable at low temp (E)	90	Size Coating

E - Embossable

Product Properties

Product	Viscosity	NVV	Solvent	Misc. EtOH	Type	Tg °C	Application
SA24-1	500 cps	45%	Toluene		Ultra High Tg (E) NC compatible	125	Adhesive
SA24-15	3500 cps	50%	MEK		Ultra High Tg	125	Size Coating
SA24-16	675 cps	30%	Ethyl Alcohol, Acetone		Durable Chemical Resistance	Cross Linked	Size Coating
RA17-1	25 cps	25%	Toluene		NA	NA	Release Coating
RA44-6X15	100 cps	15%	Toluene Acetone		NA	NA	Release Coating

Key Resin Properties for HSF

- **Tg – Determines Embossibility and Stampability of the Size Coat**
  - **More Brittle = Clean Break**
  - **Less Brittle = Embossable**

  } Noveon can Balance These Properties

- **Viscosity/Solids – Determines the Application Characteristics**
  - **Films Applied Very Thin**

- **Miscibility in Ethanol**
  - **Preferred Solvent in Adhesives/Size Coats**
  - **Won't Attack the Lacquer Coat**