Introduction to Synthetic Label Materials

Basic Application Engineering Series

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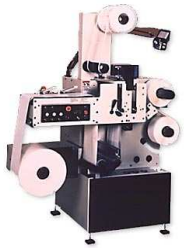
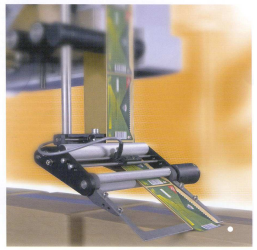
Performance Criteria for Label Face-stock

- **Printing**
  - Good Printability

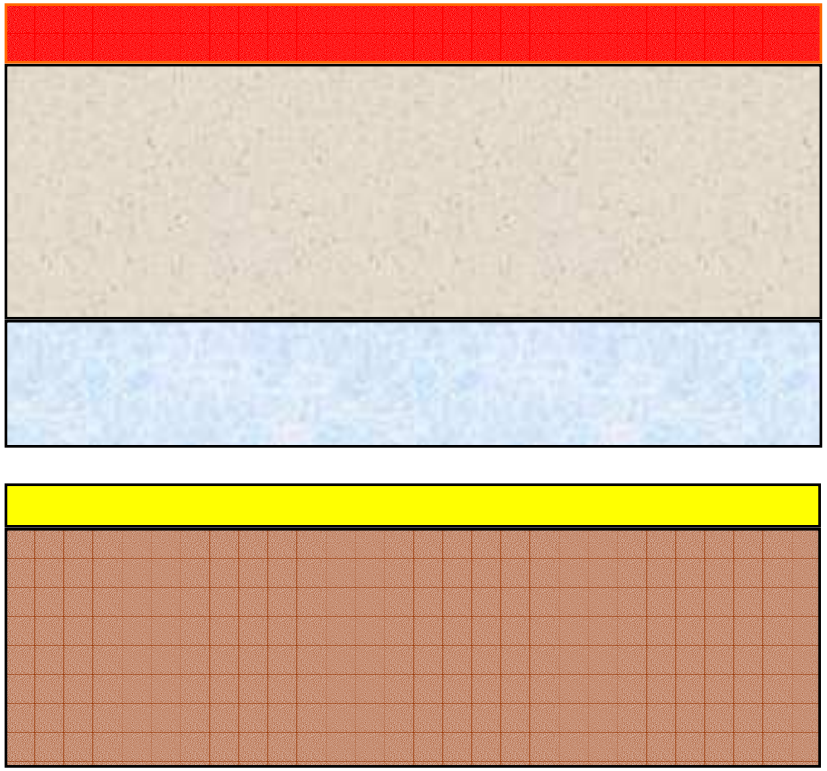




- **Converting & Dispensing**
  - Good Die-cut & Stripping ability
  - Good high speed Dispensability

- **End-use Application**
  - Good Conformance
  - Withstand Service Conditions

Typical Synthetic Label Construction



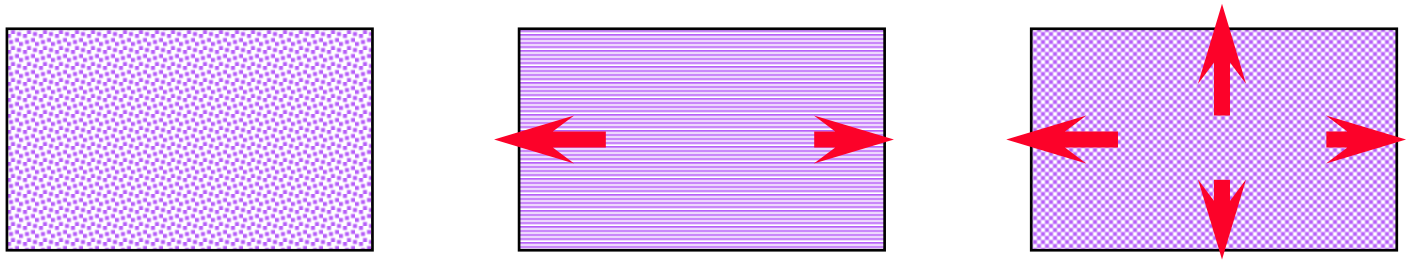
3 Areas of Considerations in Assessing Synthetic Face-stock Performance

- Mechanical Properties
  - Determined by Polymer Orientation Structure
  - Which in turn determined by its Manufacturing Process
- Chemical & Physical Properties
  - Determined by its Polymer Structure
- Surface Treatment for Printing
  - Determined by the Surface Treatment method

Orientation of Plastic Film

- Why orientate plastic film ?
  - ➔ Reduce Elongation
  - ➔ Higher Machine Direction Stiffness

Types of Orientation

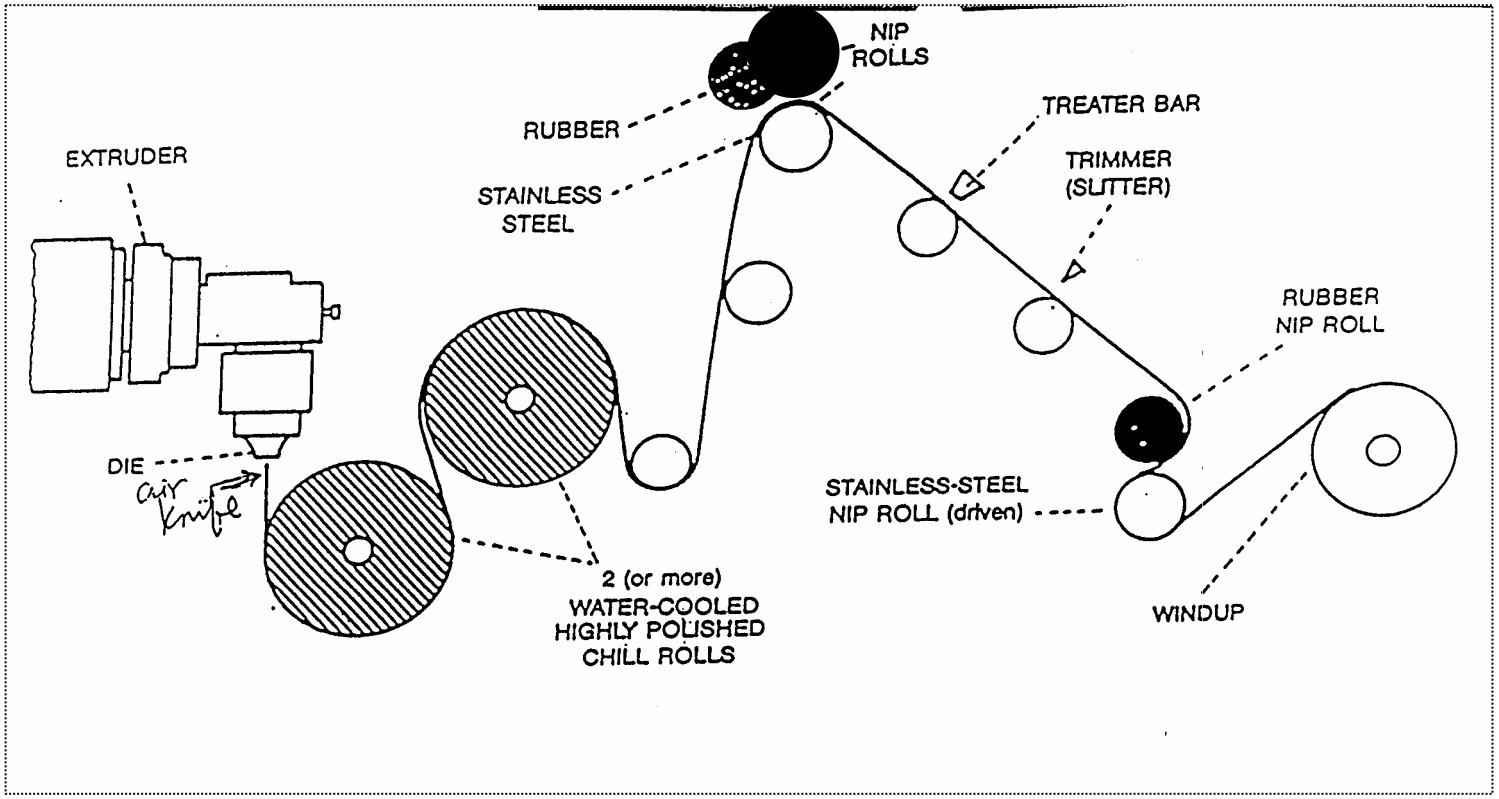


Non-Oriented

Mono-axial Orientation

Bi-axial Orientation

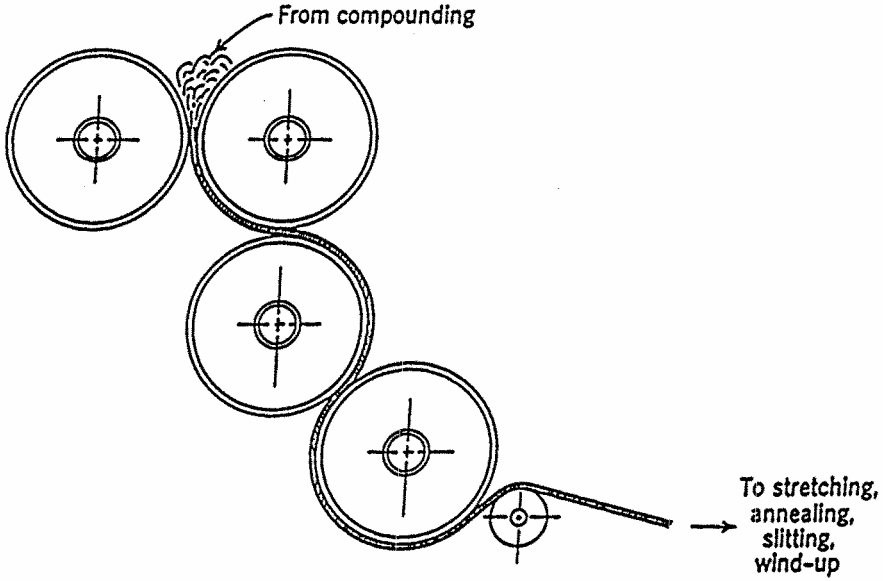
Cast Film Process



This produce Non-Oriented Film

E.G. PVC Films for outdoor

Calendered Film Process

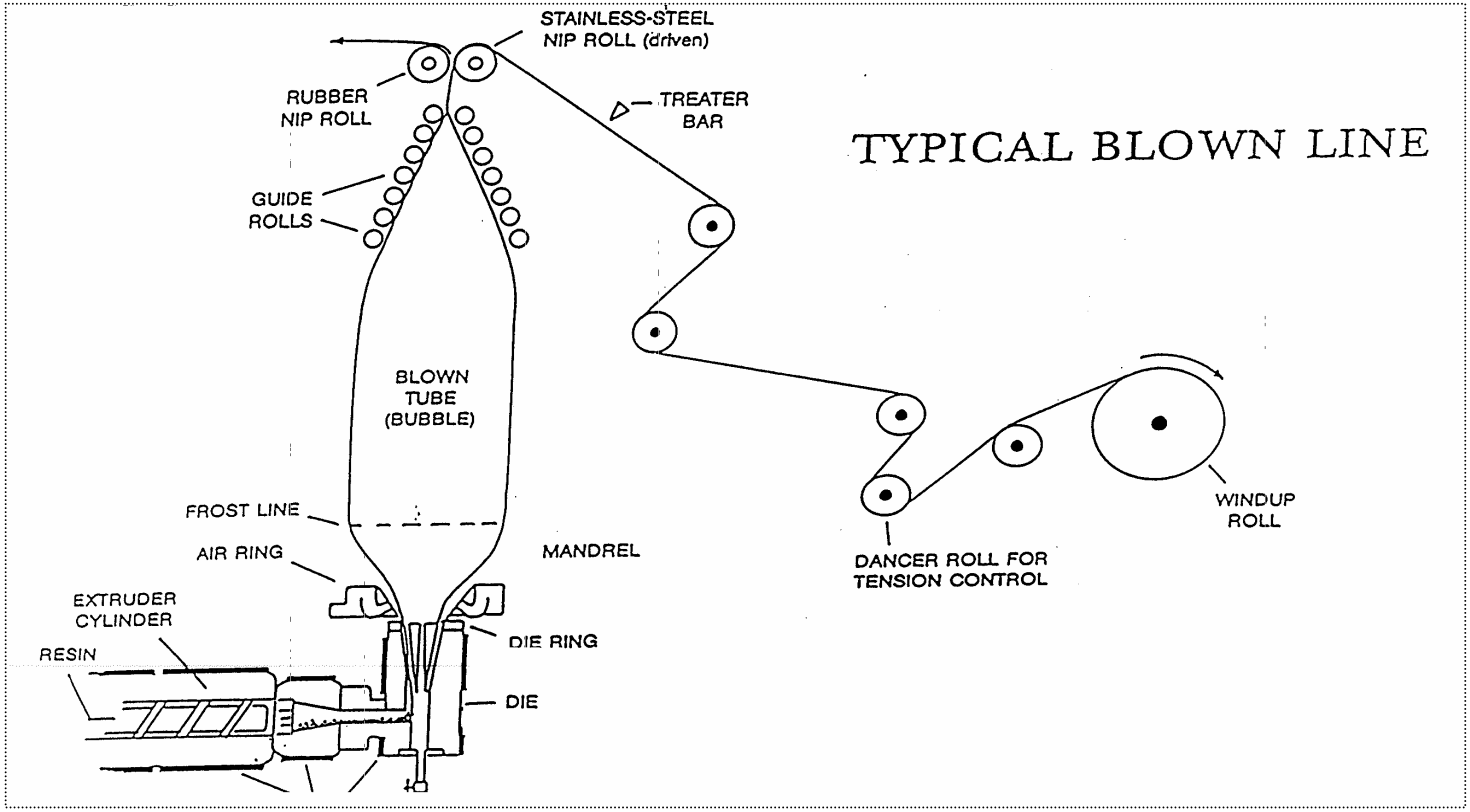


Formation of film and sheeting by calendering. Ingredients are resins, stabilizers, plasticizers, fillers, and pigments.

This produce Mono-axially Oriented Film

E.G. PVC Film for Indoor & PE Film

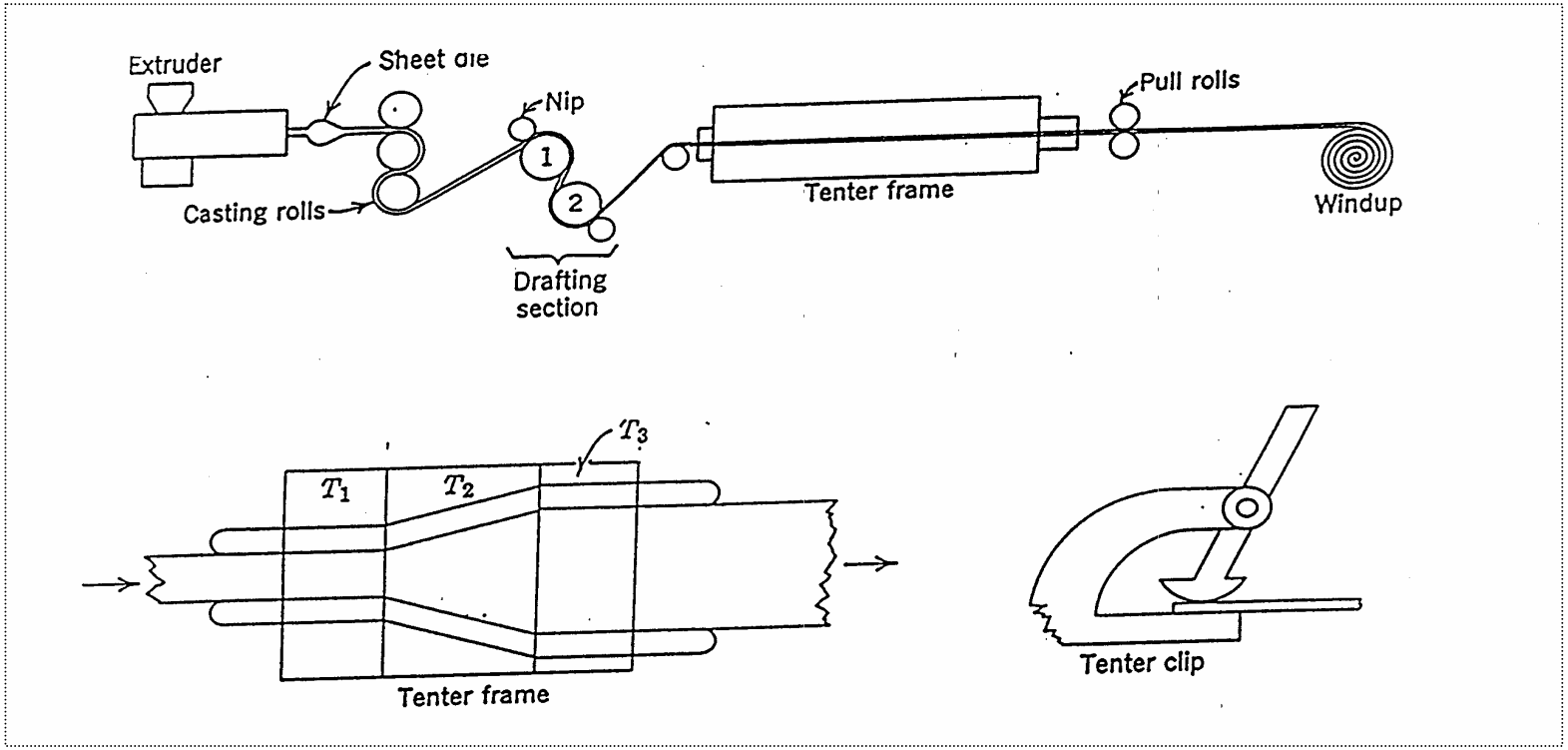
Blown Film Process



This produce slight Mono-axially Oriented Film

E.G. PE Film

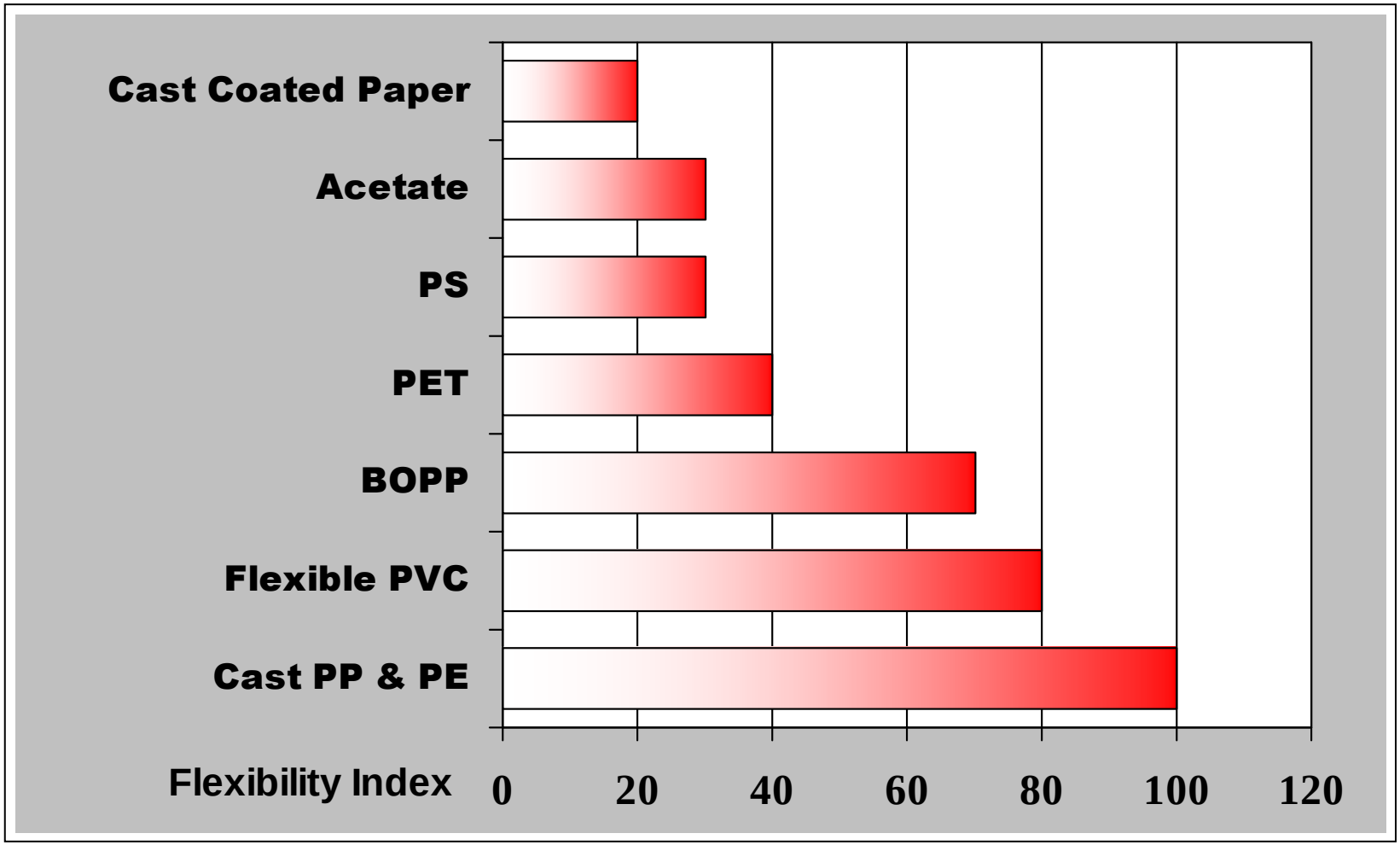
Biaxially Orientated Film



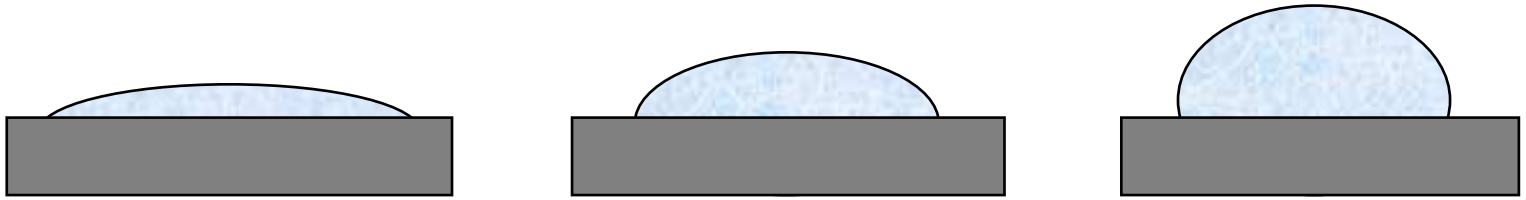
This produce Bi-axially Oriented Film

E.G. PP & PET Film

Conformabilities/Flexibilities



Surface Energy of Materials



High Surface Energy Substrate

- Copper (Cu)
- Aluminum (Al)
- Stainless Steel (SS)
- Glass

Medium Surface Energy Substrate

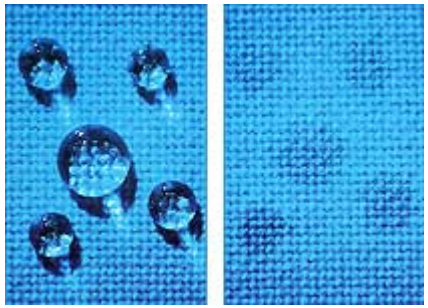
- Polyester (PET)
- Polyvinylchloride (PVC)
- Polycarbonate (PC)
- Acrylic

Low Surface Energy Substrate

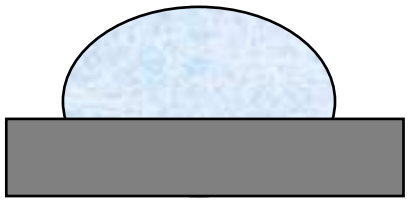
- Polypropylene (PP)
- Polyethylene (PE)
- Polystyrene (PS)
- Teflon

Surface Energy

& Principle of Wetting on Substrate



Poor wetting



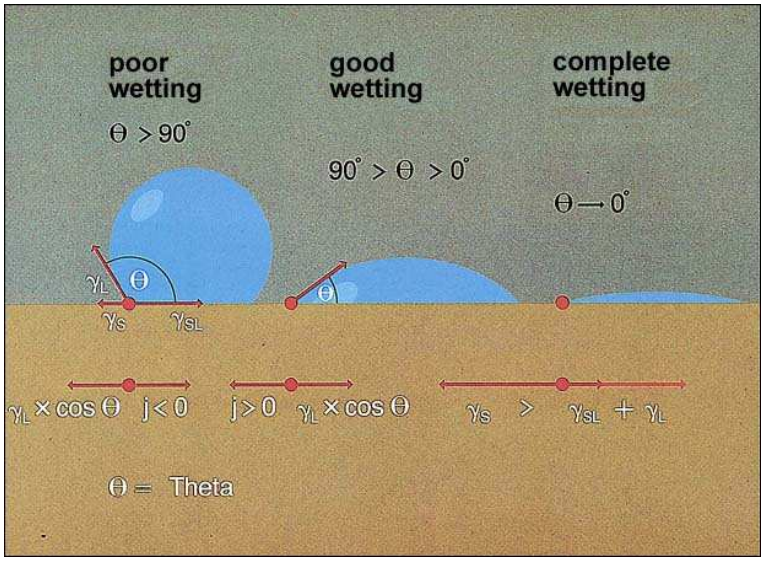
Surface Energy of Liquid > Surface Energy of Substrate

Good wetting

Surface Energy of Liquid < = Surface Energy of Substrate

Measure of Surface Energy

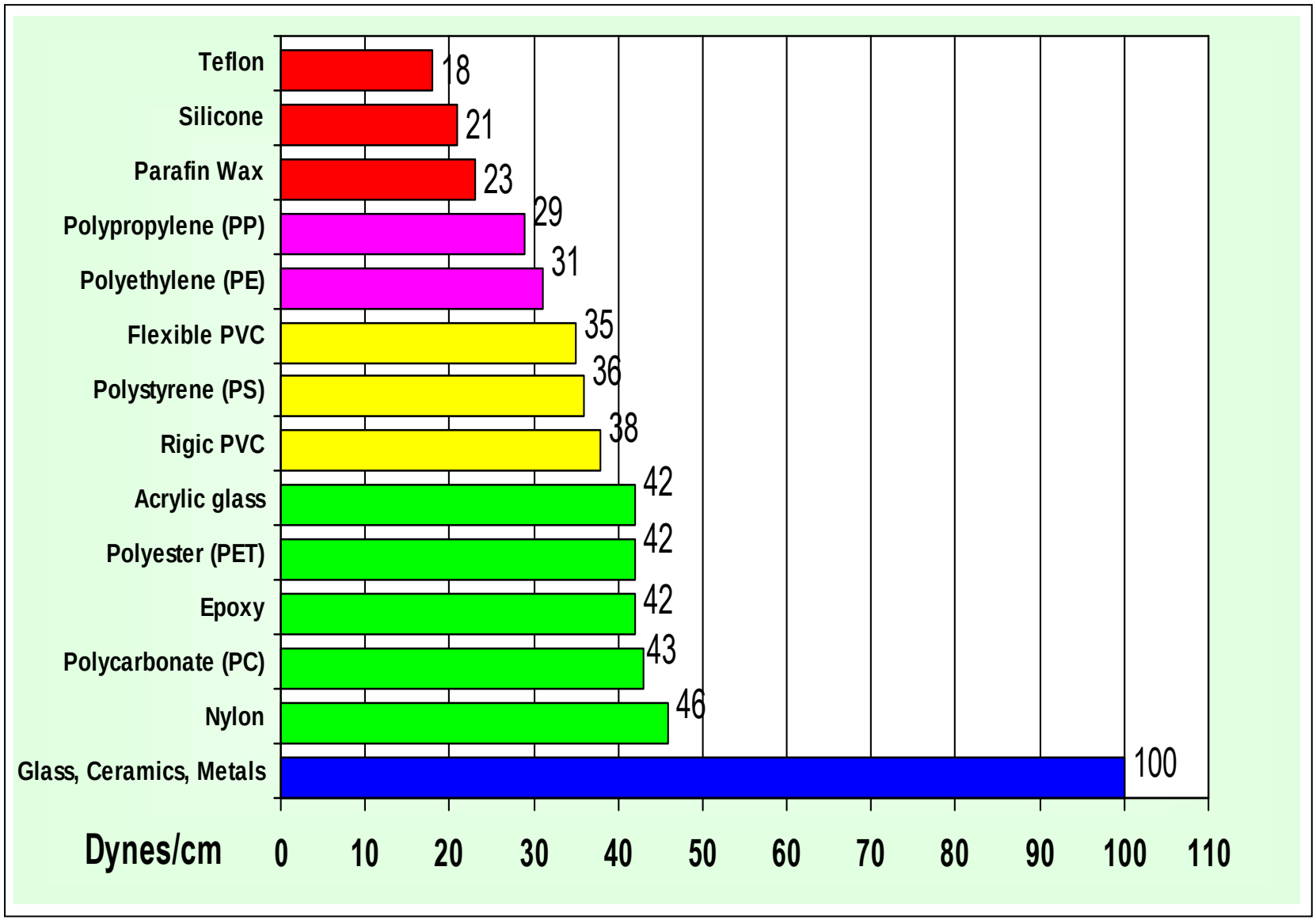
- Surface Tension is force per length;
  - in SI-units is **N / m**
  - **1 mN / m = 1 dyne / cm**



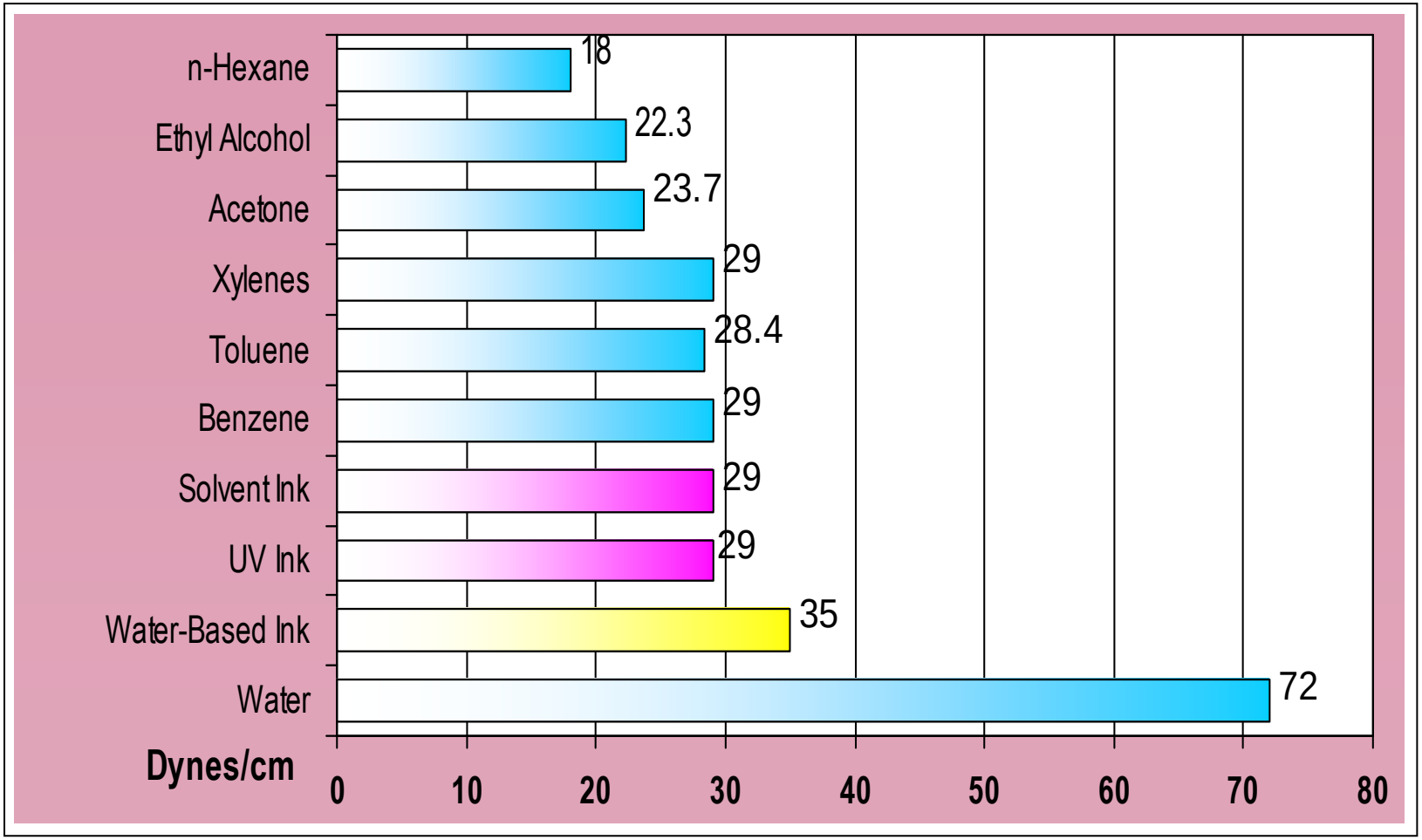
General good wetting rule:

The Dyne level of the substrate has to be at least **10 dynes** higher than the liquid being applied

Natural Surface Energy of Solids



Natural Surface Energy of Liquid



Synthetic Face-stock Treatments

Base Polymer	Corona Treatment	Top Coating	Other Treatment
PVC	No	Yes	
PET	No	Yes	
PS	Yes	Yes	
PE	Yes	Yes	FS Print Skin
PP	Yes	Yes	FS Print Skin

Corona Treatment – Altering the surface characteristic by exposing the surface to a high voltage corona discharge resulting in an increase in surface energy

Filler Surface- Consists of natural minerals (fillers) bonded with the plastic compound to provide a paper like surface properties

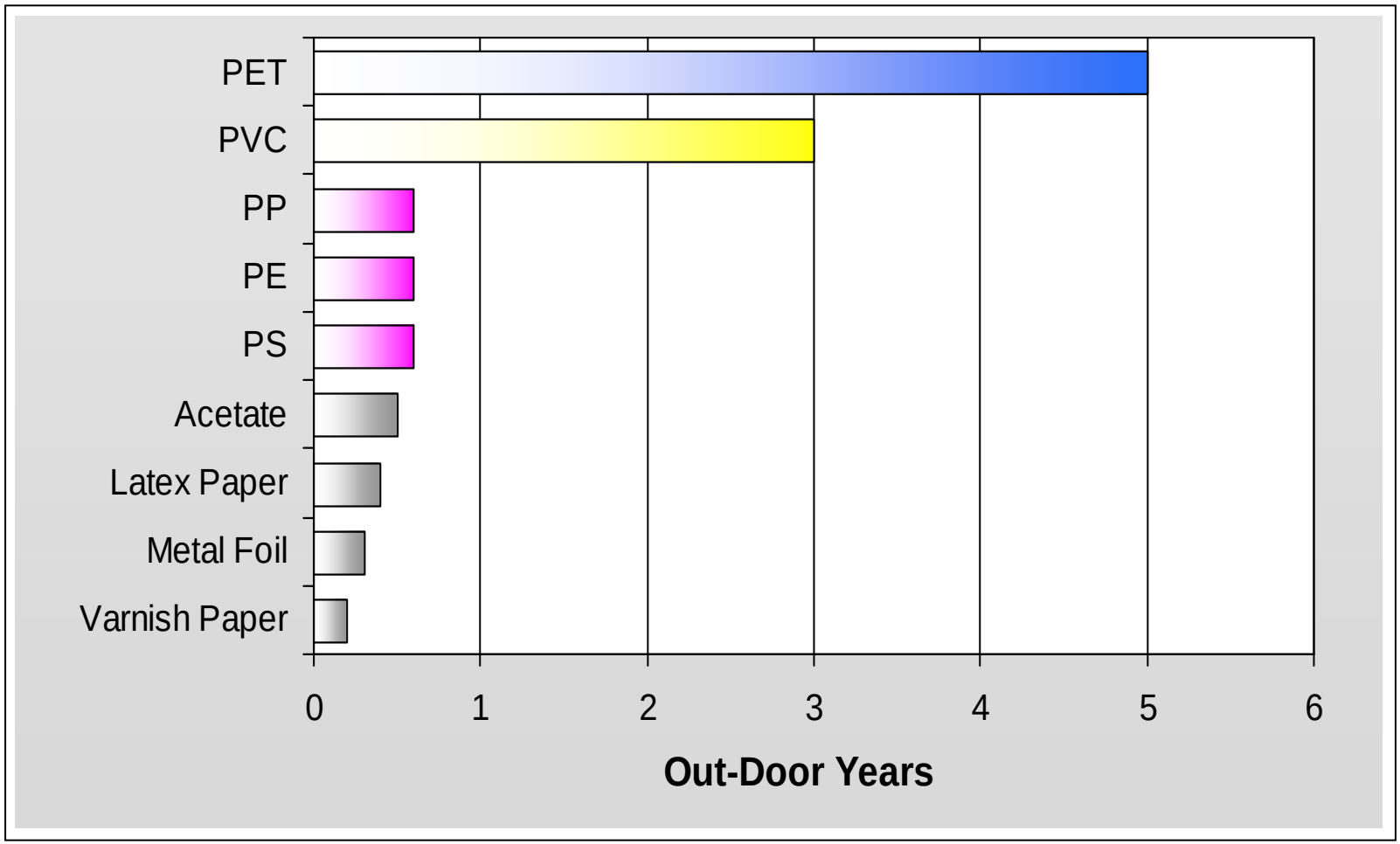
Top Coating Requirements

- Printability
- Ink Wet out
- Film Formation (No Voids)
- Ink Anchorage
- Smudge Resistance
- Chemical Resistance
- Thermal Stability
- Absorbency (Ink jet printing)

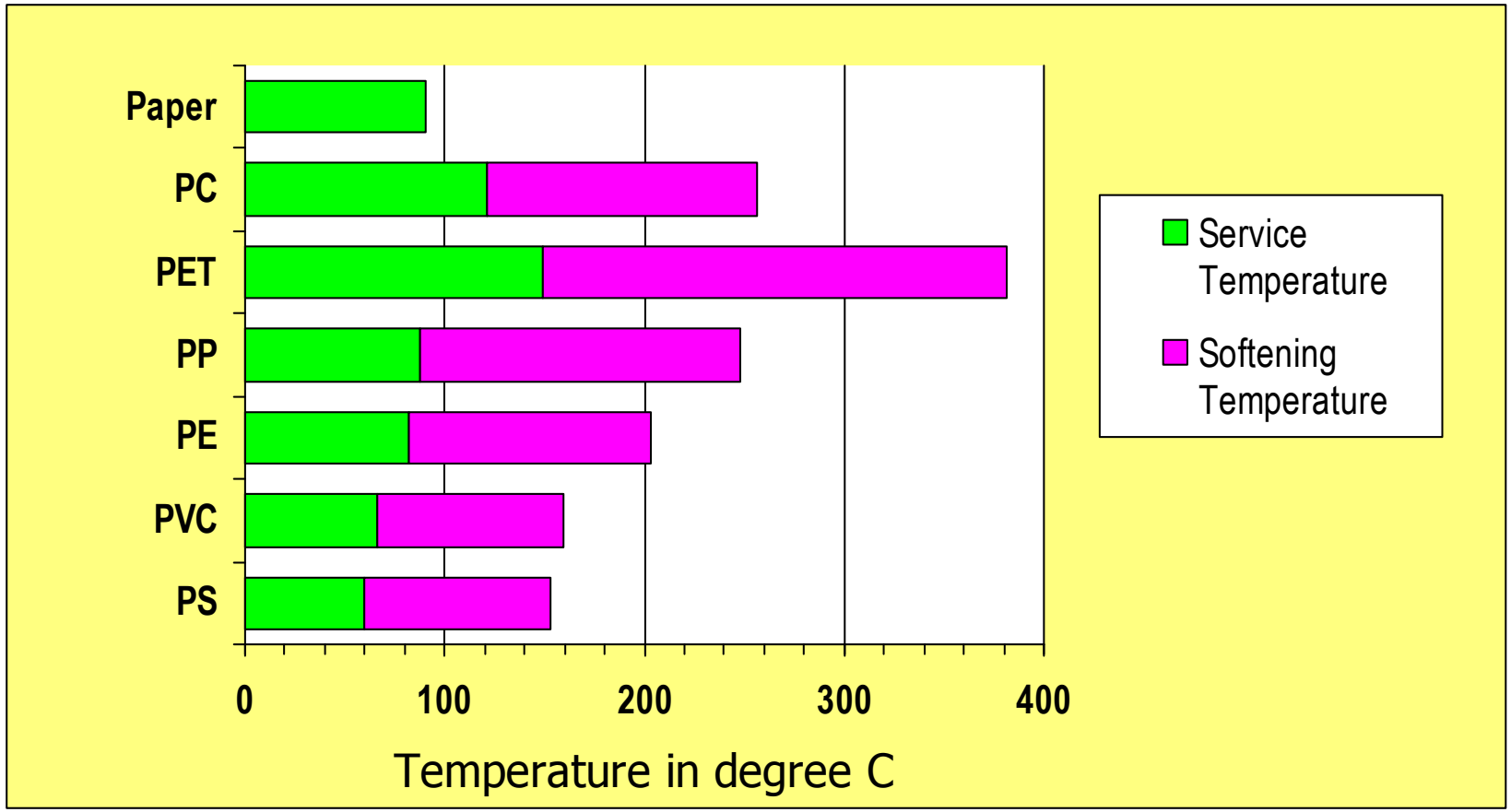
Topcoat Chemistry

- **Polymer Types**
  - Acrylic Copolymers
  - PET Copolymers
- **Process Types**
  - Solvent
  - Emulsion
  - UV / EB Cured

UV Aging Durability of Synthetic Materials



Serviceable & Heat Distortion Temperature of Common Face-stock



Synthetic Facestock Physical Properties

Base Polymer	BOPP	PET	Flex PVC	PS	LDPE
Haze (%)	3.3	2.0	2.0	3.0	15.0
Tear Resistant	Good	Excellent	Good	**Poor**	Good
Shrink Resistance	Good	Good	**Poor**	Good	Good
Heat Resistant	90°C	150°C	70°C	**60°C**	80°C
Solvent Resistant	Good	Excellent	Fair	**Poor**	Good

Film Label Materials Application Domains

Destructible / Tamper evidence	Indoor Primary Label	Outdoor Signage & Graphic	Name Plate	High Temperature (> 150°C)	Special Application
Acetate	**PP** **Filled PP**	**PVC**	**PET**	**Polyimide** (Kapton)	Digital / Laser print **PET** **CPP**
PS	**PE** **Polyolefin** **Filled PO**	**CPP**	**PC** (Lexan)	**Fluoro-polymer** (Teflon)	Tear resist **Tyvek / Valeron**