Introduction to Pressure Sensitive Adhesive Technology

Process Engineering Technical Training Series

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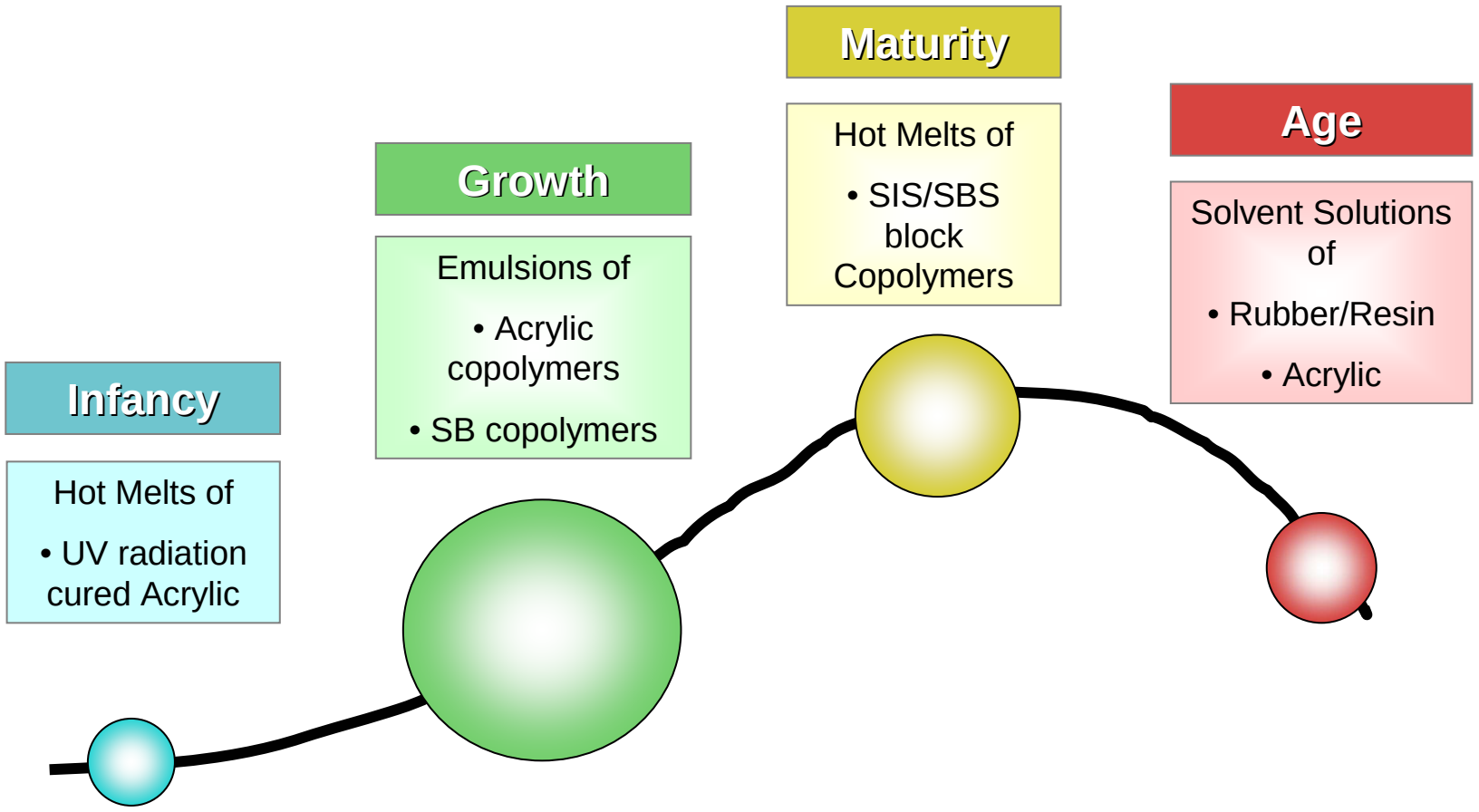
Definition of PSA

(Pressure Sensitive Adhesives)

A special class of adhesive that is:

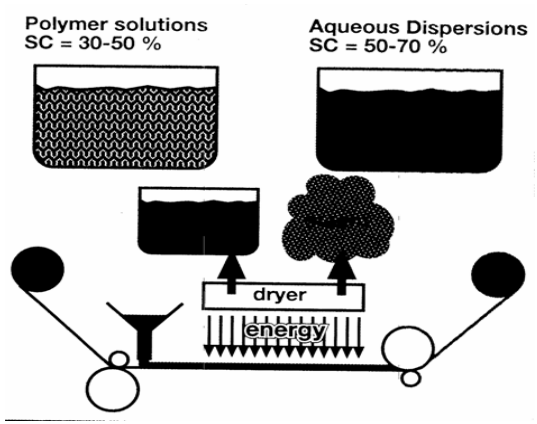
- *Permanently tacky at Room Temperature*
- *Spontaneously adhere on contact or with little pressure*
- *Require no activation by water, solvent or heat to form a strong bond*

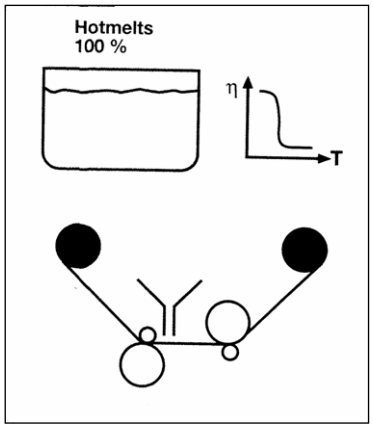
PSA Polymers Life Cycle

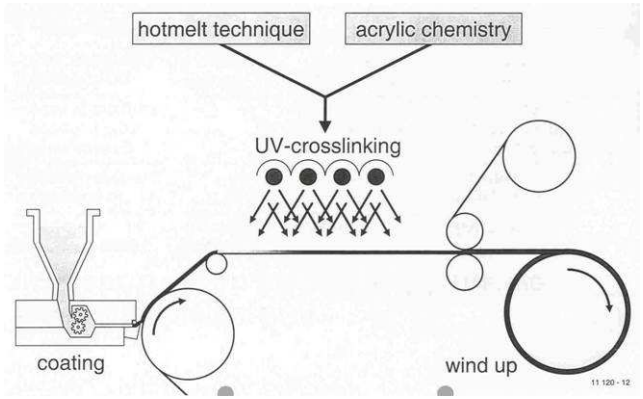


Common PSA Classification

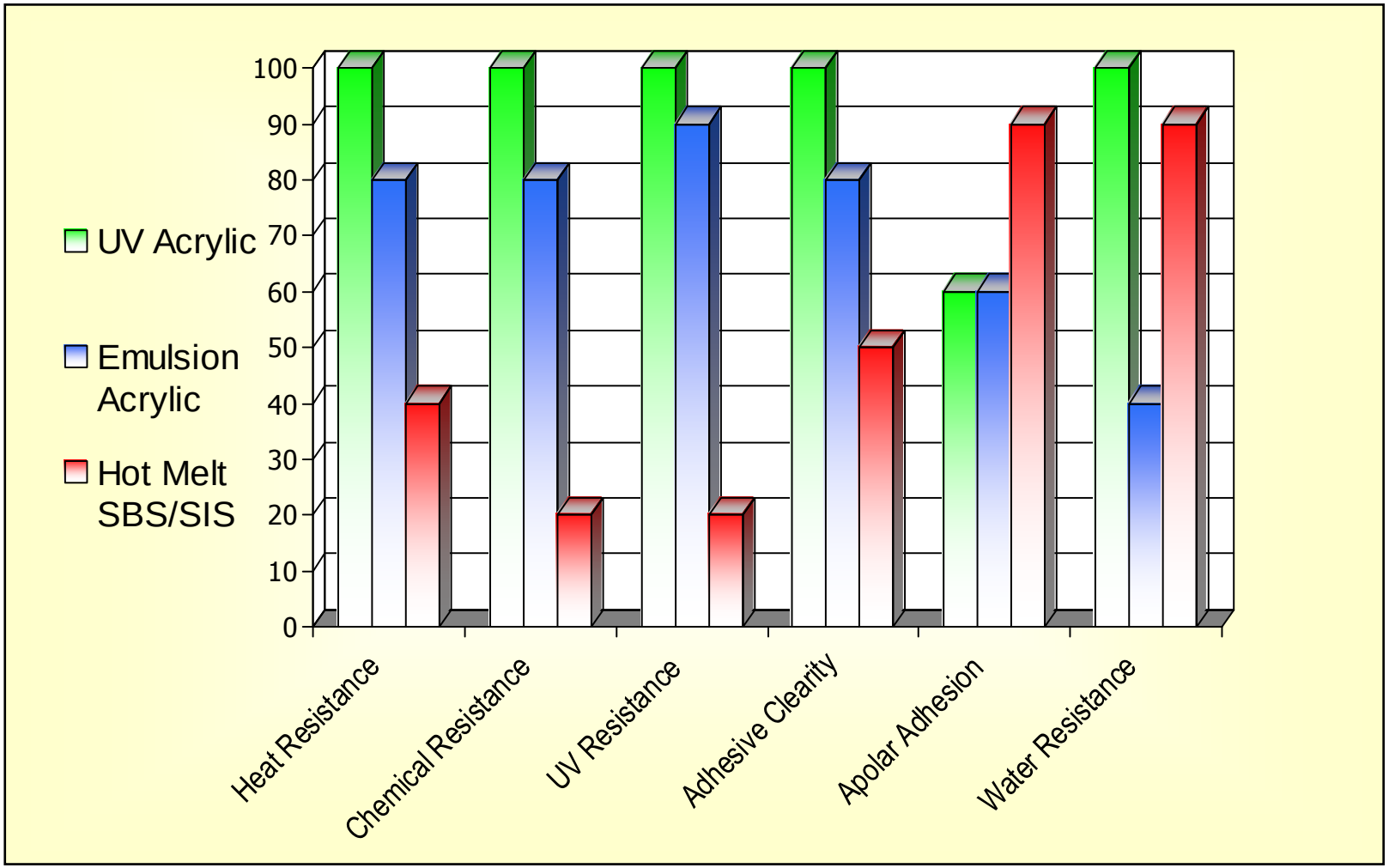
	Solvent	*Emulsion*	*Hot Melt*	*UV Hot Melt*
Silicone	High Temperature	None	None	None
Acrylic	Specialty	Most Common	Developmental	Emerging
Rubber	Few	Few	Common	Emerging



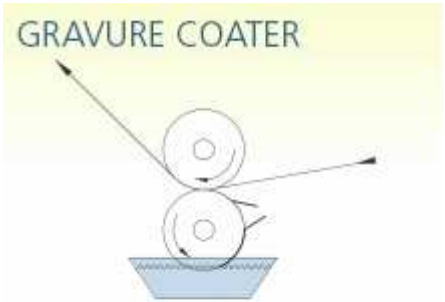


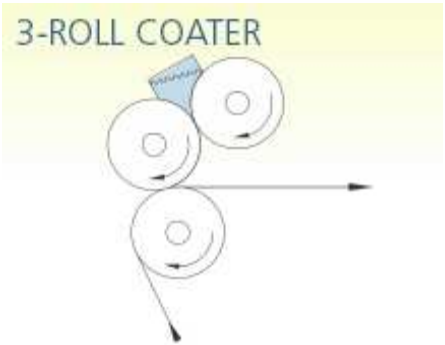


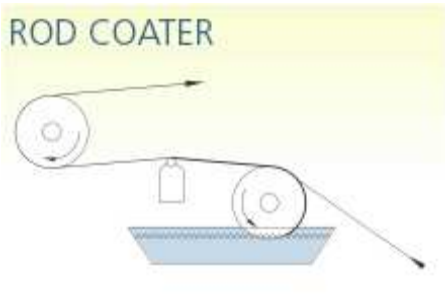
Typical PSA Polymer Performance

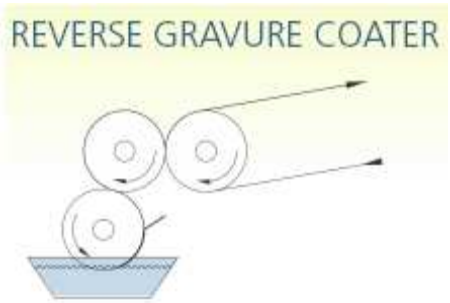


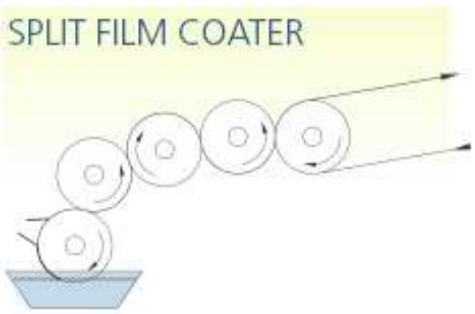
Common PSA coating methods

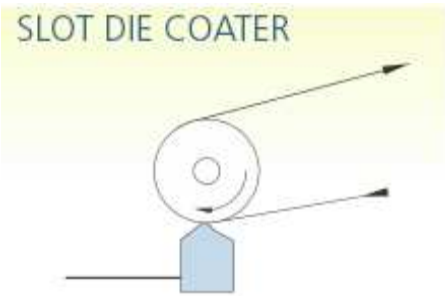


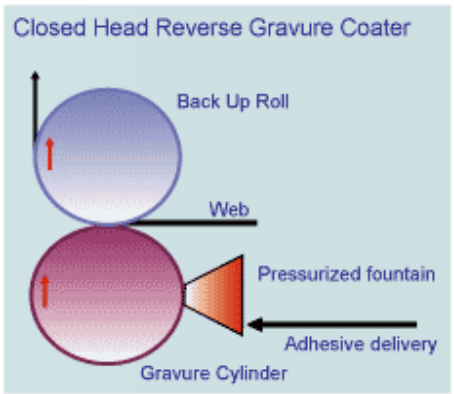


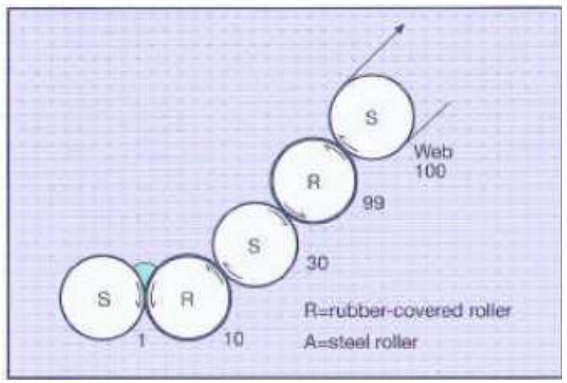


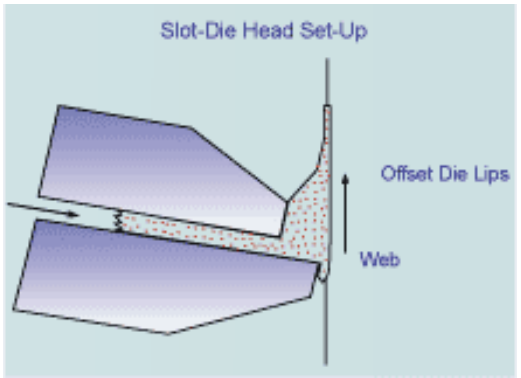








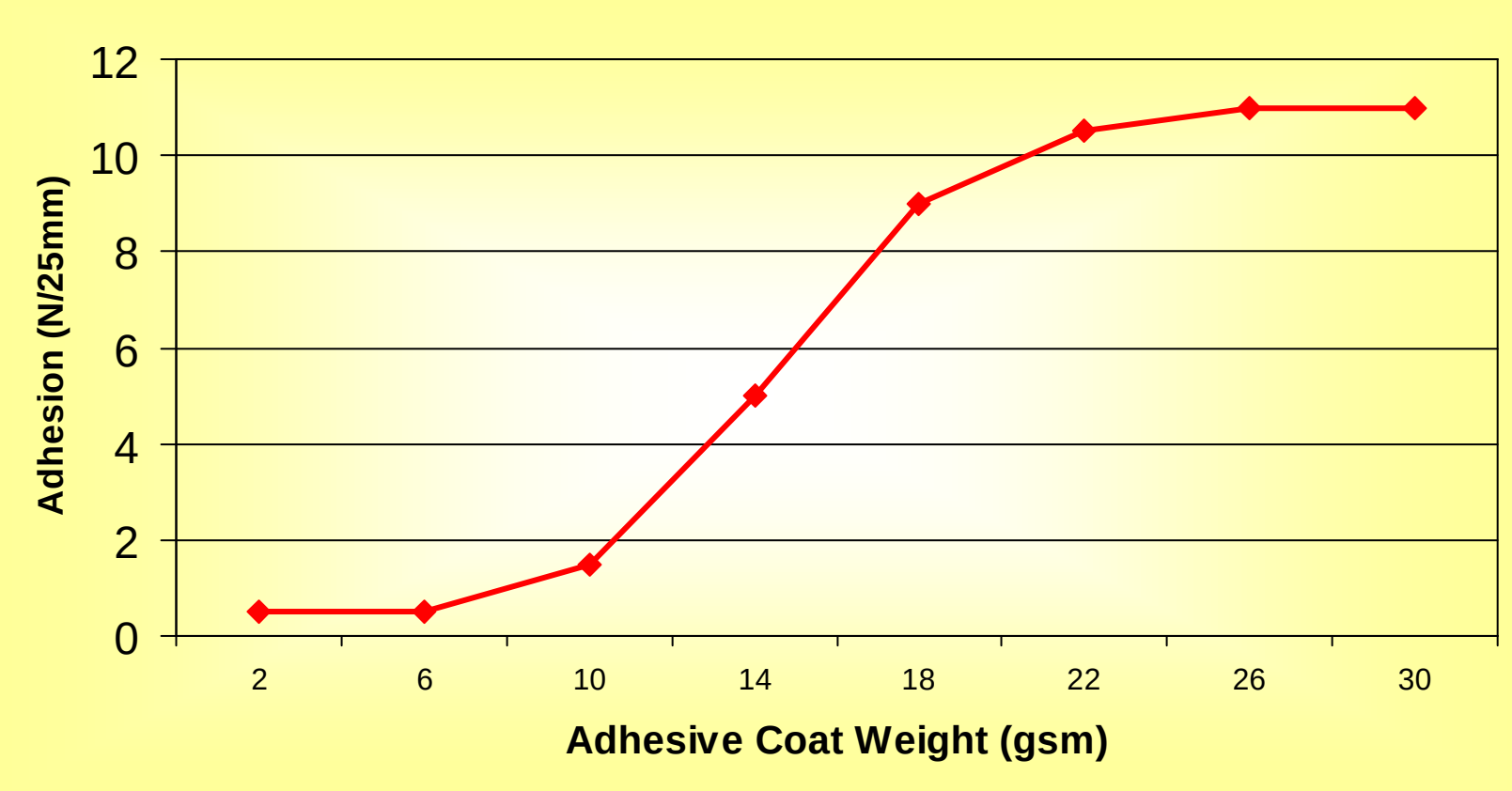




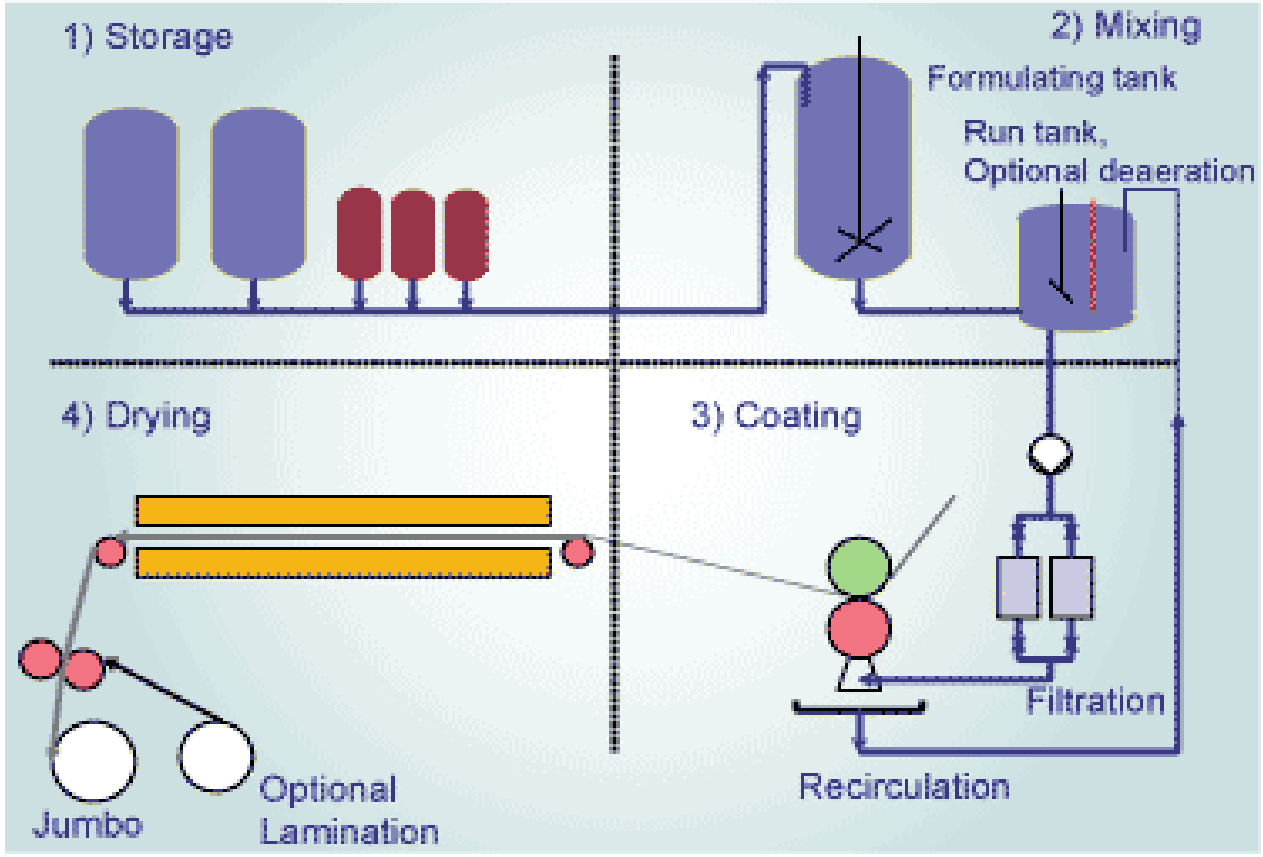
Capabilities / Limitations of Common Coating Methods

Coating Method	Viscosity,> cps	Coating Weight, gm/m^2	Coating Accuracy, +/- %	Coating Speed, m/min	Type of Adhesives Commonly Used
Wire rod	100-1,000	15-100	10	100-150	Solution, emulsion
Knife over roll	4,000-50,000	25-750	10	100-400	Solution, emulsion,100% solids
Reverse roll	300-50,000	25-250	5	100-700	Solution, emulsion
Gravure	15-1500	2-50	2	100-700	Solution, emulsion
Extrusion die	400-500,000.	15-750.	5	300-700	Emulsion, hot melt, 100% solids
Slot die	400-200,000	20-700	2	100-300	Emulsion, hot melt, 100% solids
Curtain	50,000-125,000	20-500	2	100-500	Emulsion, hot melt

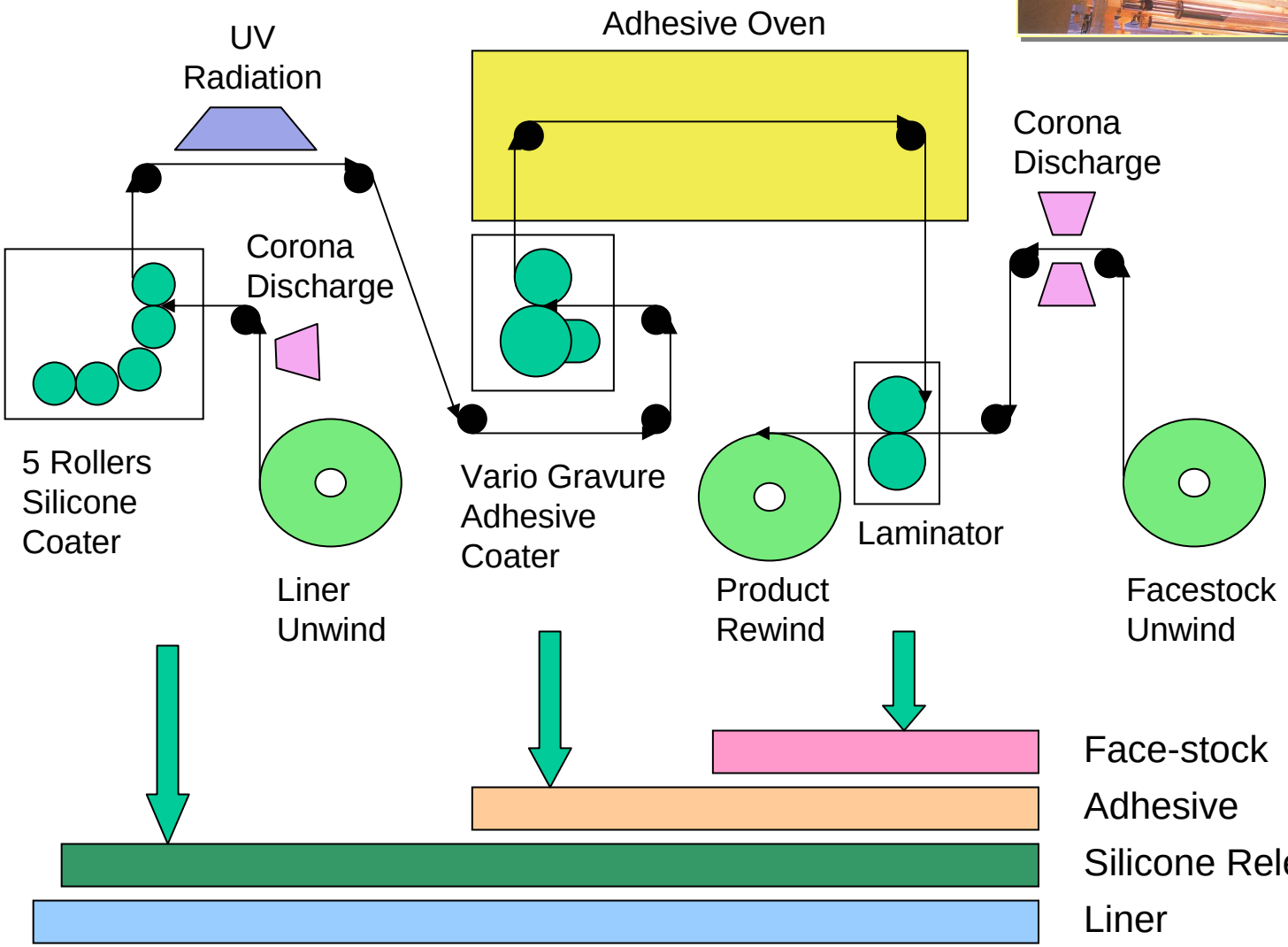
Variation of Adhesion with Coat Weight



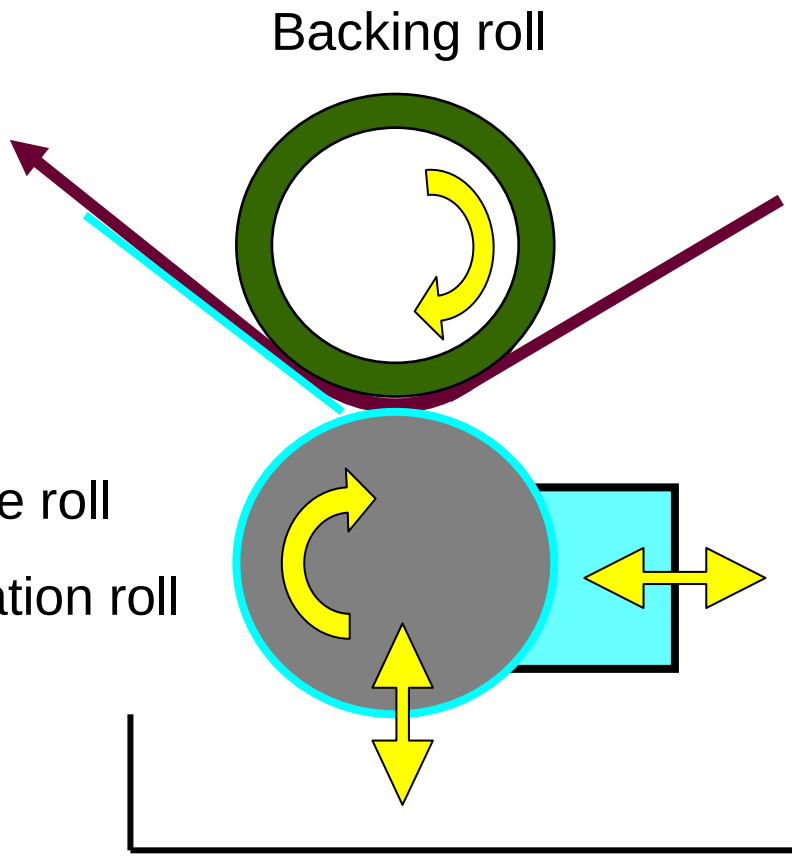
Typical Emulsion PSA Materials Manufacturing Process



Emulsion PSA Label Manufacturing Process



Emulsion Vario Gravure Coater

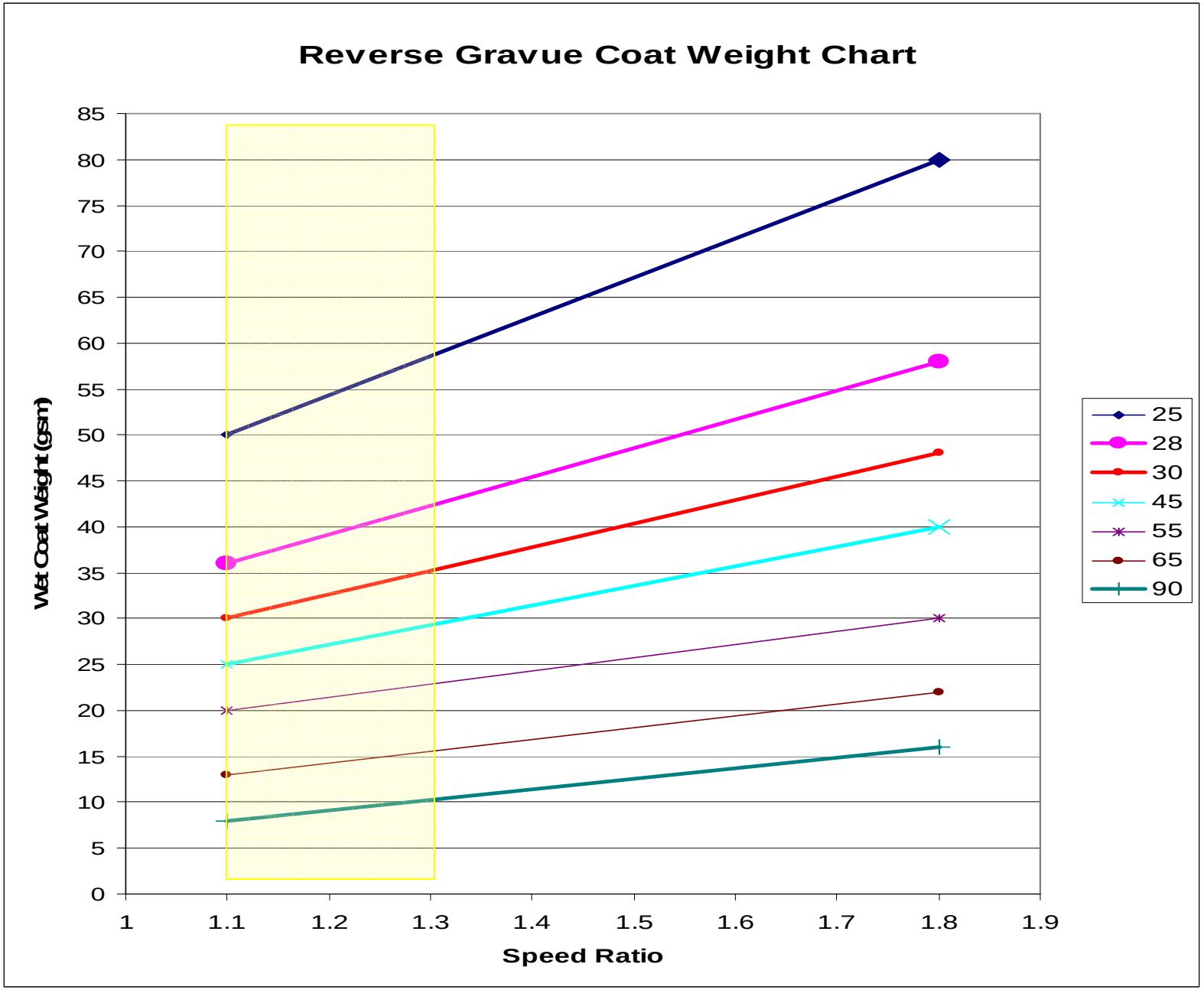


Speed Ratio

Application roll / Line Speed
Ratio Range: 1.1 -1.3

Feed box

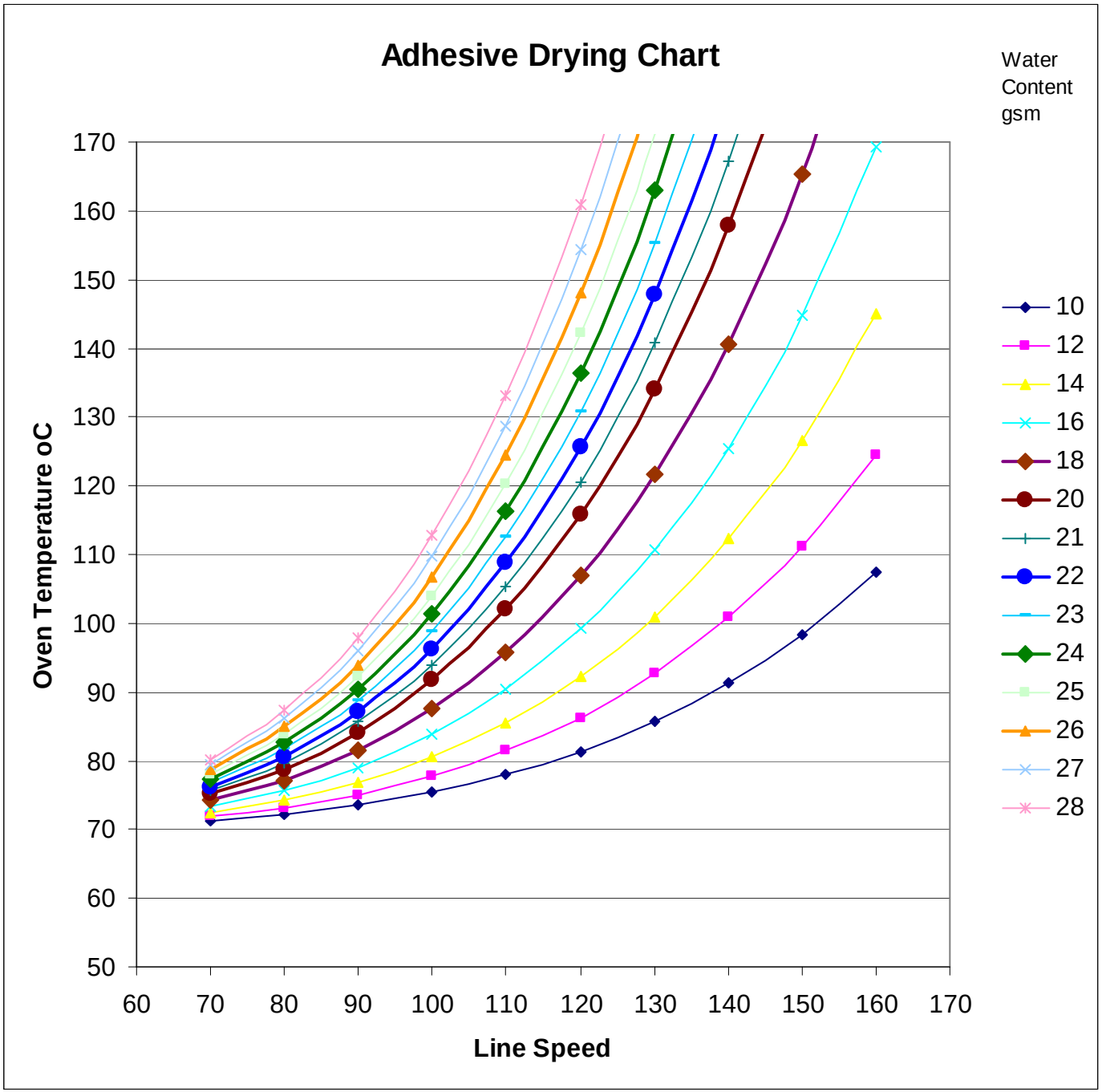
Pressure Range: 0.2 -0.6 bar
Above Atmospheric Pressure



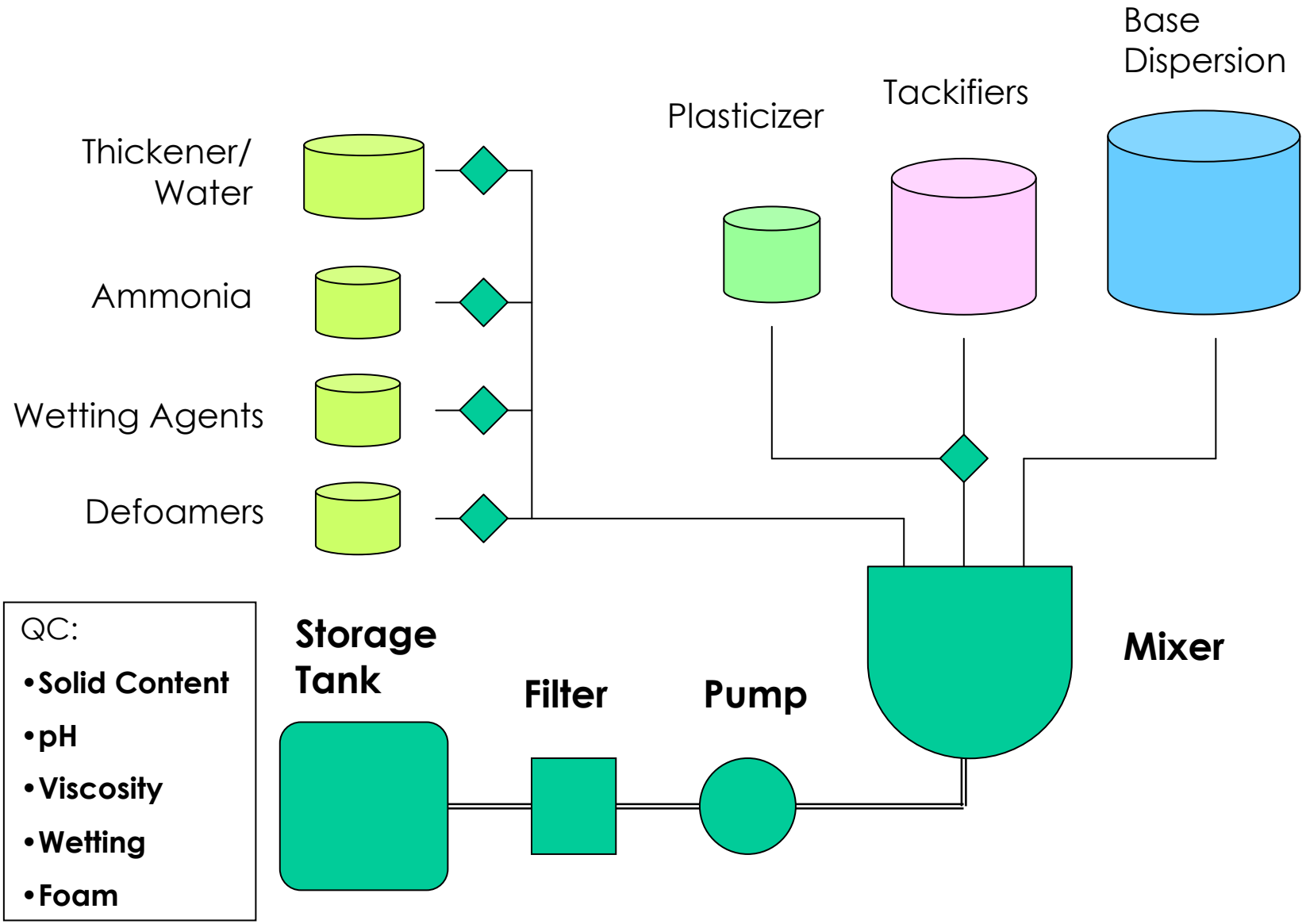
Relative Effects of Parameters on the Evaporation Time of Polymer -Water Mixtures

Parameter	Range Investigated	Effect on Evaporation Rate %
Relative humidity, %	10-90	60.2
Temperature, ℃	20-40	20.2
Air speed, l/min	10-30	1.6
Water content, %	60-100	<0.1
Other		10.2

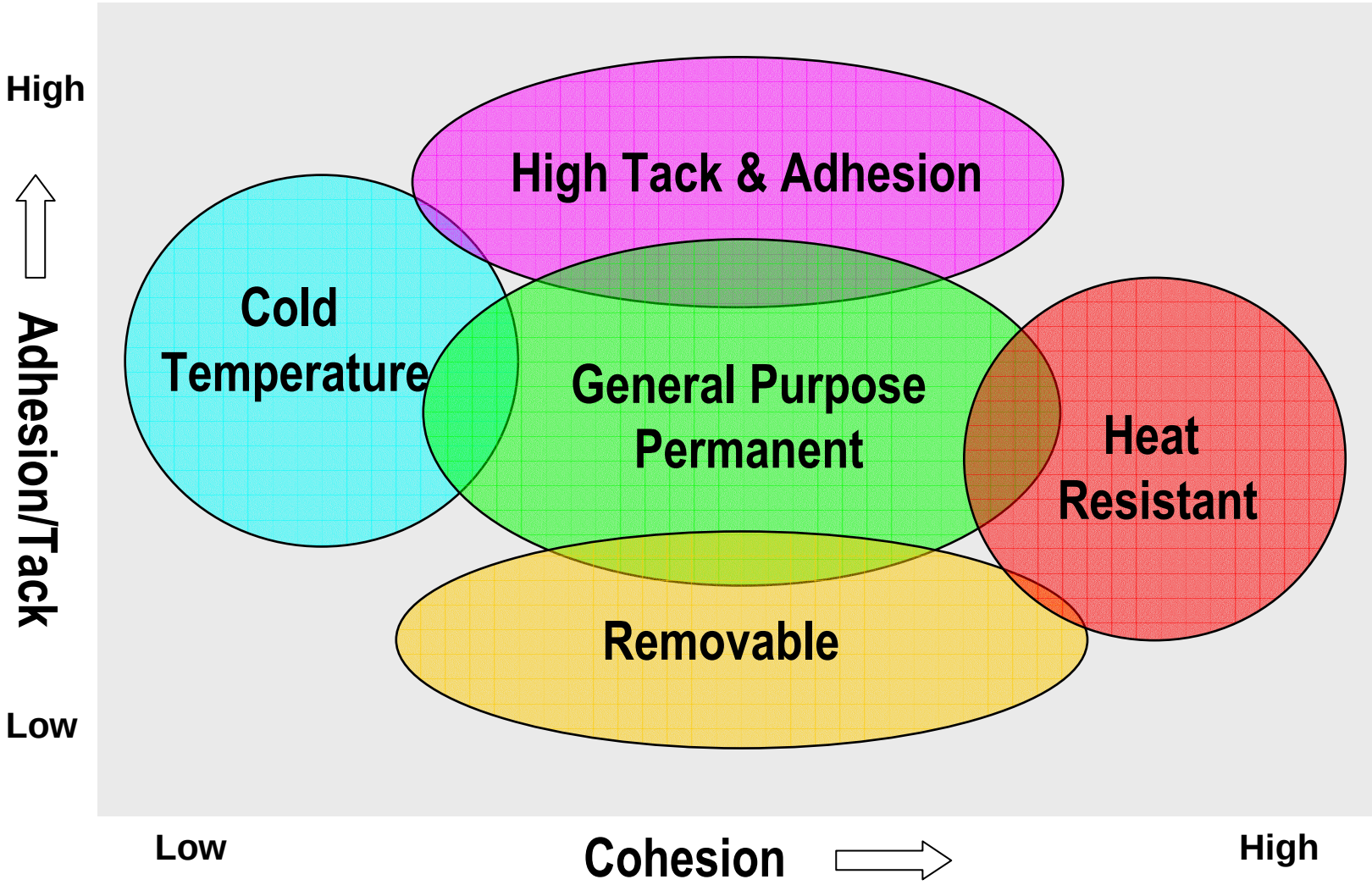
The combination of hot air and infrared radiation are well suited for the accelerated drying of waterborne adhesives and coatings. This is probably the most effective variation in formulation or production to gain a large improvement in speed. The hot air primarily affects the coating surface while the IR radiation, depending on the wavelength can penetrate into the deeper layers of the coating. With the IR method, favored evaporation of water can be achieved through irradiation in the OH band region



Formulation of Emulsion PSA



Classification of Adhesive by Common Functions



Quality Control after Coating Process

Quantitative Criteria:

1. Adhesion
2. Initial Tack
3. Cohesion
4. Coat Weight

Qualitative Criteria:

1. Adhesive Voids
2. Air Bubbles
3. Foreign Particles
4. Clarity