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ESTABLISHED IN 1976

Coating Methods

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Coating is a very Important process involved in Manufacture of Coated Products

Today we shall review some of these as listed below.

- ***Gravure Coating***
  - *Comma Coating*
- ***Reverse Roll Coating***
  - *Hot Melt Coating*
- ***Metering Rod / Myer Bar Coating***
  - *Knife over roll coating*
- ***Slot Orifice coating***
  - *Immersion / Dip coating*
- ***Curtain Coating***

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To understand the process of coating an adhesive on a substrate for the manufacture of Adhesive tape is quite simple .

Let's quote the example spreading butter on bread.
The Butter must have good spread ability in order to apply it evenly .

Try spreading frozen butter on bread and you will learn the difficulties encountered.

Similarly, the adhesive to be coated must have good **spread ablity**.

And let's not forget one must have a **correct equipment** to spread or coat the adhesive.

There are other variable factors also involved , but we shall look into coating methods Exclusively.

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The Coating methods

Their Capabilities and Limitations

Coating Method	Viscosity in CPS	Max Speed per Min	Coating Wt . gm per sq. mtr
Gravure	100-2000	700 Mtrs.	3.-20.
Comma	1000-6000	300	10-200
Reverse Roll Nip	1000-6000	300	10-200
Reverse Roll Pan	200-6000	100	10-200
Hot Melt	500-20000	300	10-300
Myer Bar	10-200	200	3.-25.
Knife over Roll	100-20000	1500	3.-15.
Slot Orifice	500-20000	200	20-100
Immersion / Dip Coating	1000-10000	50	Heavy
Curtain	500-20000	200	20-100

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Gravure Coating

The **gravure coating process** relies on an engraved roller running in a coating bath, which fills the engraved dots or lines of the roller with the coating material.

The excess coating on the roller is wiped off by the **Doctor Blade** and the coating is then deposited onto the substrate as it passes between the Engraved roller and a Pressure Roller.

There are three different ways of gravure roll manufacturing . One has to choose a correct type depending upon the required coating gram mage and the material to be coated

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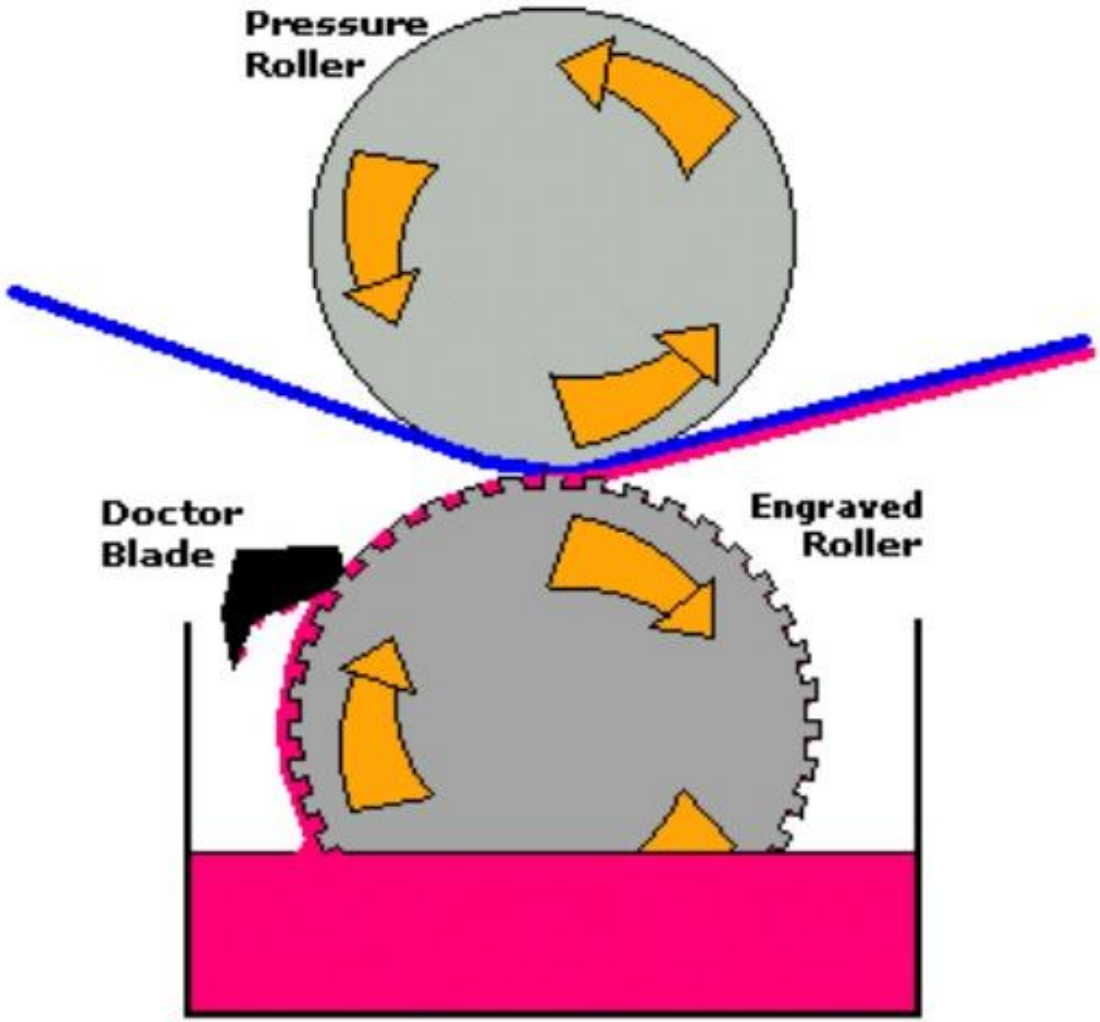

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CHARACTERISTICS OF ENGRAVED GRAVURE ROLLERS

Type of Engraving	*Screen*		*Cell Depth mm*	*Deposit gm/ m^2*
	Lines/in	*Lines/cm*		
Pyramidal	200 40	79 16	0.003 0.037	2.4 27.6
Quadrangular	200 16	79 6	0.005 0.065	3.6 49.5
Trihelical	120 24	47 9	0.010 0.055	11.7 63.1

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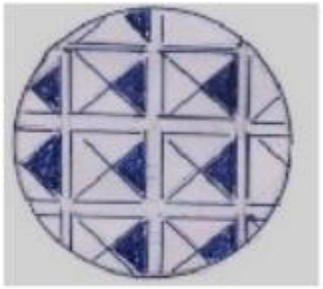
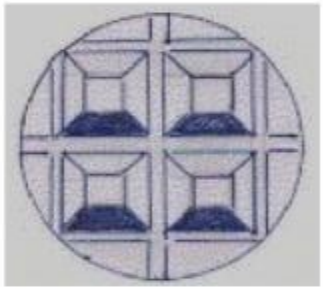
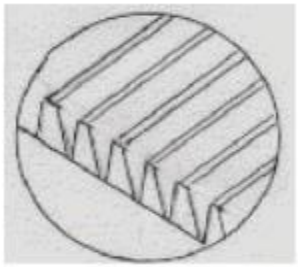


Pyramidal cells

Quadrangular





Tri helical

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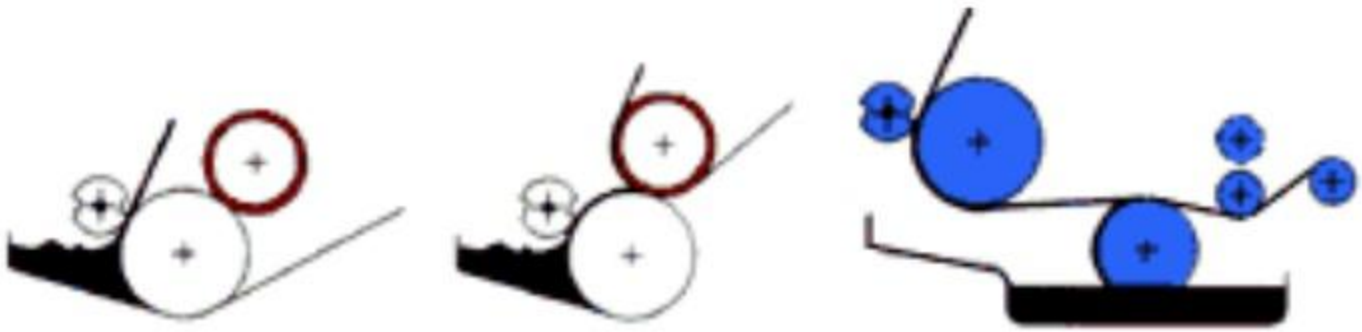
Comma Coating



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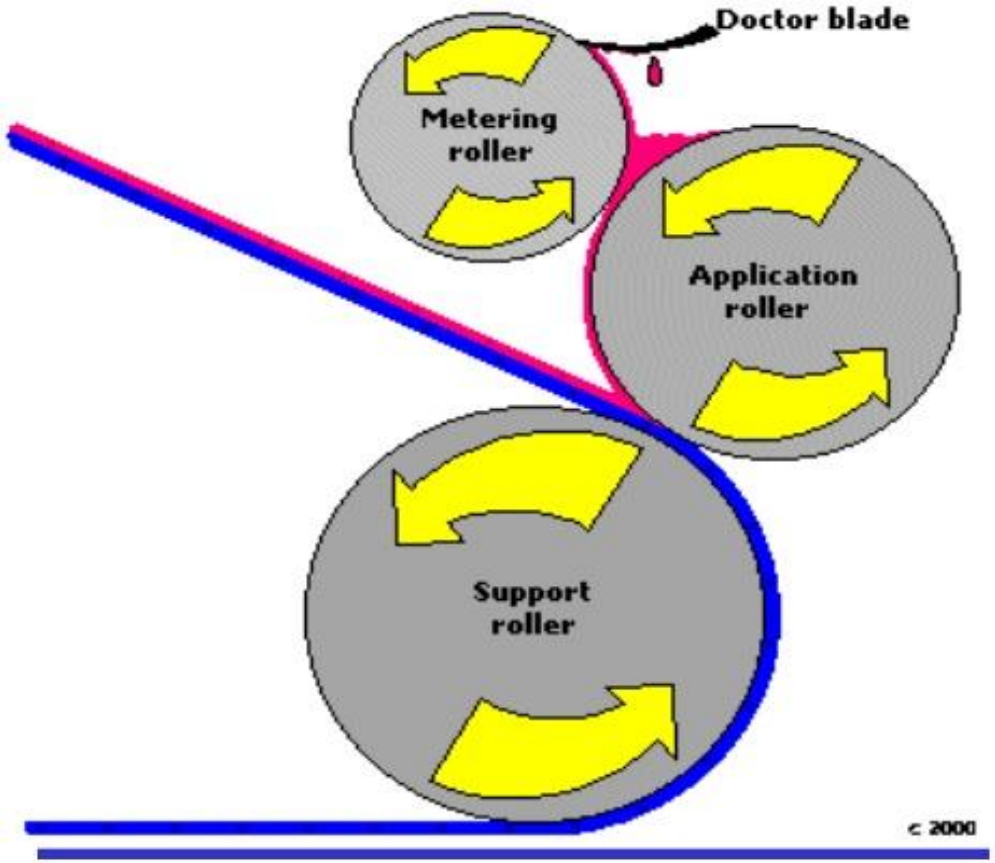
Reverse Roll Coating



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Reverse Roll Coating

In this procedure, the coating material is measured onto the applicator roller by precision setting of the gap between the upper metering roller and the application roller below it.

The coating is 'wiped' off the application roller by the substrate as it passes around the support roller at the bottom.

The diagram illustrates a 3-roll reverse roll coating process, although 4-roll versions are common.

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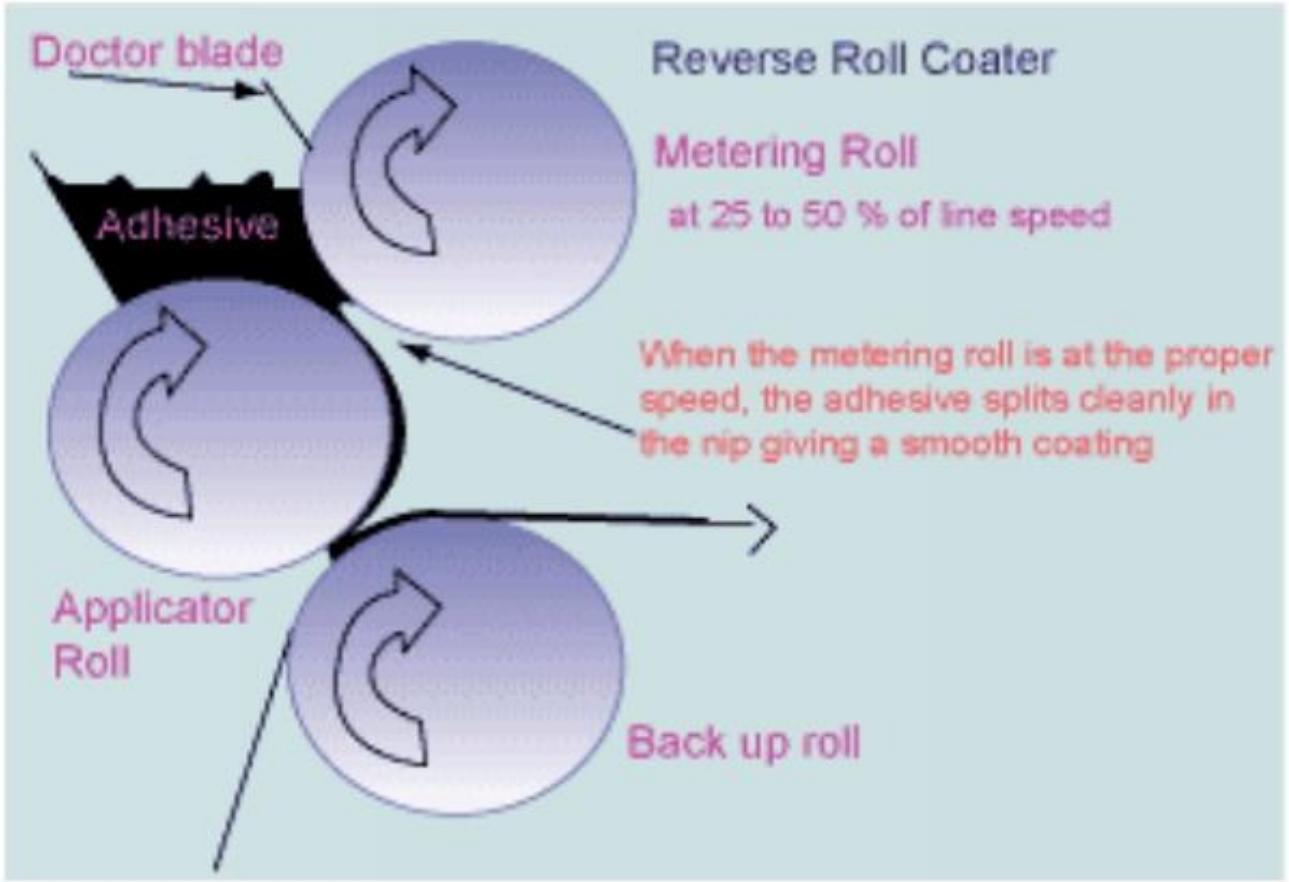
Reverse Roll Coater

The three roll reverse coater is used for many specialty applications. This method is more expensive and generally slower in line speed than the Mayer rod coater. However, the versatility in terms of coat weight range and coating width, and the good coat quality of the three roll reverse has made it popular with many converters. In this process, the middle roll is coated with a precise thickness of adhesive, determined by the size of the gap between the top and middle rolls. The adhesive is then transferred as the rubber backing roll brings the web into contact.
The adhesive coat weight can also be varied by increasing or decreasing the speed of the applicator roll relative to the web speed. The metering roll speed can be varied to adjust the smoothness of the coating.

Figure 2 : Reverse Roll Coater

There are several variations of the reverse roll coating method, such as four-roll, nip fed, and pan fed systems. A nip-fed, three roll reverse coater is shown here. Medium to high coat weights are possible with reverse roll.


Doctor blade
Reverse Roll Coater
Metering Roll
at 25 to 50 % of line speed
Adhesive
When the metering roll is at the proper speed, the adhesive splits cleanly in the nip giving a smooth coating
Applicator Roll
Back up roll

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Myer Bar Coating

In this coating process, an excess of the coating is deposited onto the substrate as it passes over the bath roller.

The wire-wound metering rod, sometimes known as a Meyer Rod, allows the desired quantity of the coating to remain on the substrate.

The quantity is determined by the diameter of the wire used on the rod.

This process is remarkably tolerant of non-precision engineering of the other components of the coating machine.

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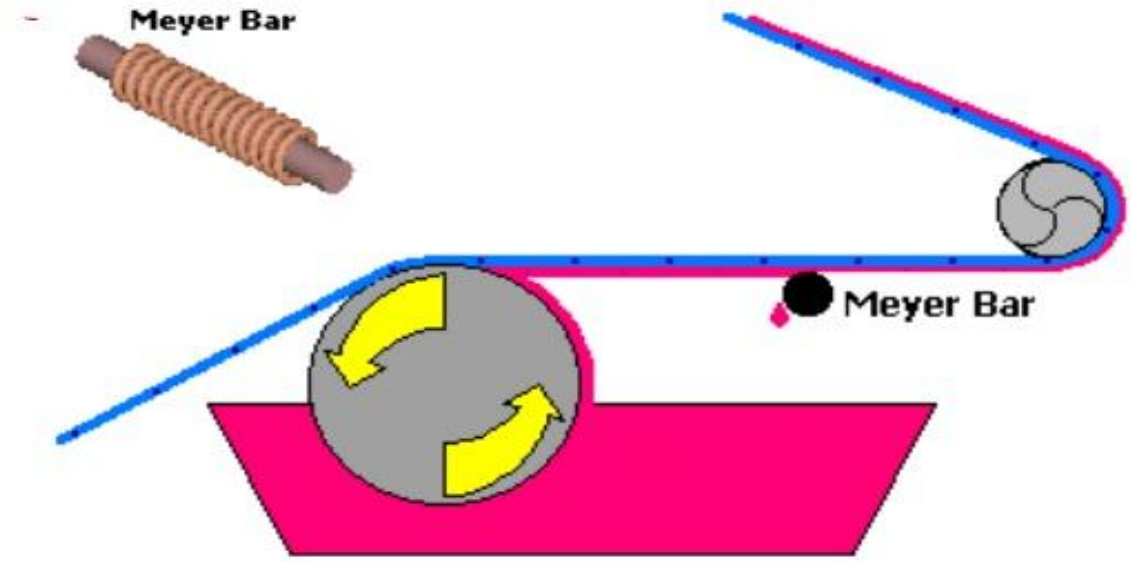

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The market for wire-wound rods has grown rapidly during the past few decades, because they provide predictable, accurate coatings time after time, at a minimal cost. Although the technology goes back almost a century, today's high quality materials, multi-wire designs and special wire surfaces have made this system more popular than ever before.

Rods give users the ability to fine-tune coating thickness quickly and easily, without altering the chemistry of their coating material, and without time-consuming and expensive changeovers.

Wire-wound rods were first used in coating machines built by Charles Mayer in the 1900's to manufacture waxed paper and carbon paper. They are still called "Mayer Bars" by many coaters.

Wet coating thickness can be accurately predicted within one tenth of a mil (.0001"). Rod selection tables allow coaters to consider coat weight and percent of solids in choosing the proper rod size for each production run.

Bottom-line profits have encouraged many coaters to modify existing machines, in order to take advantage of the flexibility, the ease of use and the dollar savings associated with rod coating.

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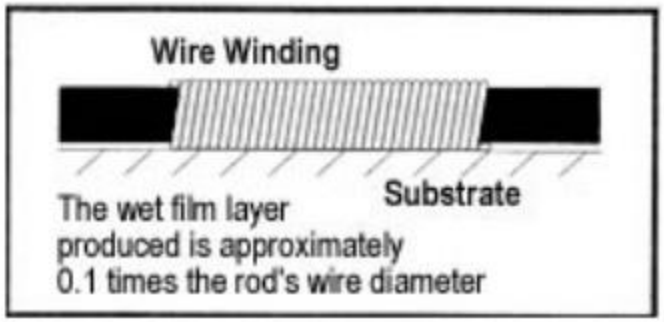
Coating Rods are accurate easy to u inexpe



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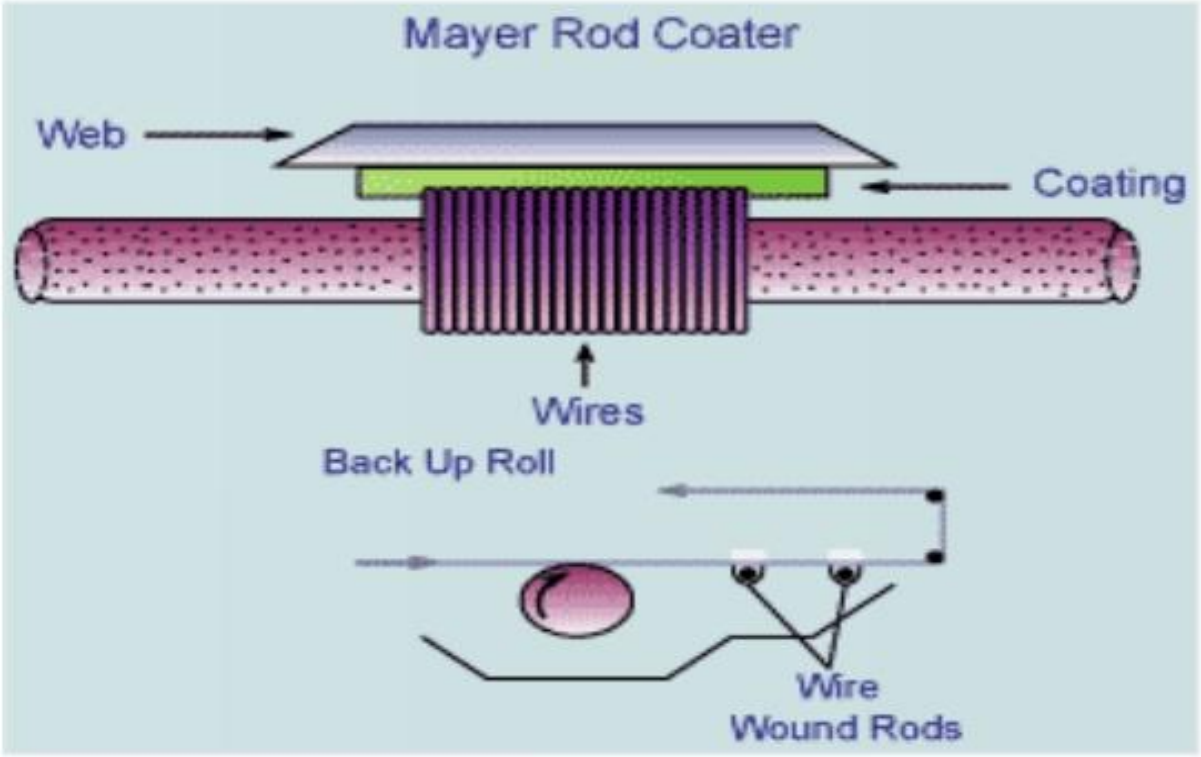
One of the more common methods of coating is the Mayer rod coater, sometimes called a metering rod coater. This equipment has advantages such as low capital cost, ease of coat weight adjustment, ease of operation, and a broad range of coat weights are possible.



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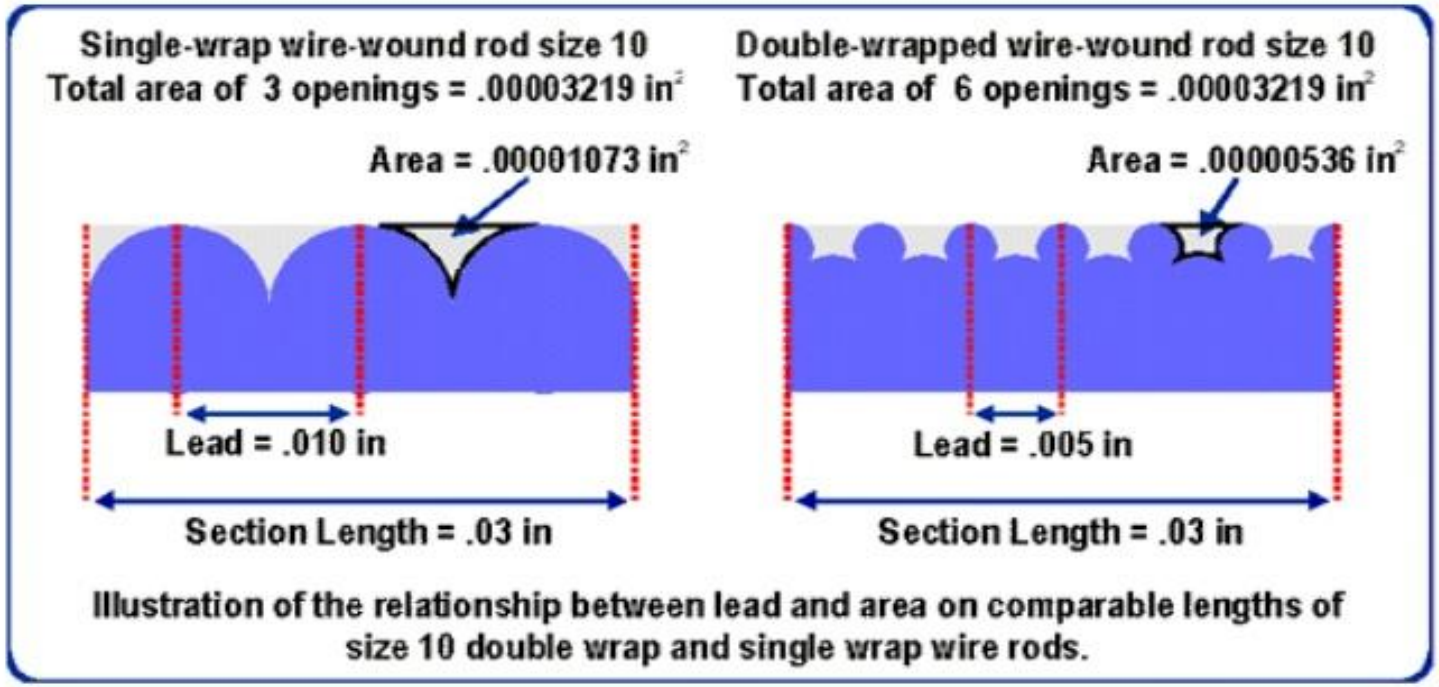

Illustration of the relationship between lead and area on comparable lengths of size 10 double wrap and single wrap wire rods.

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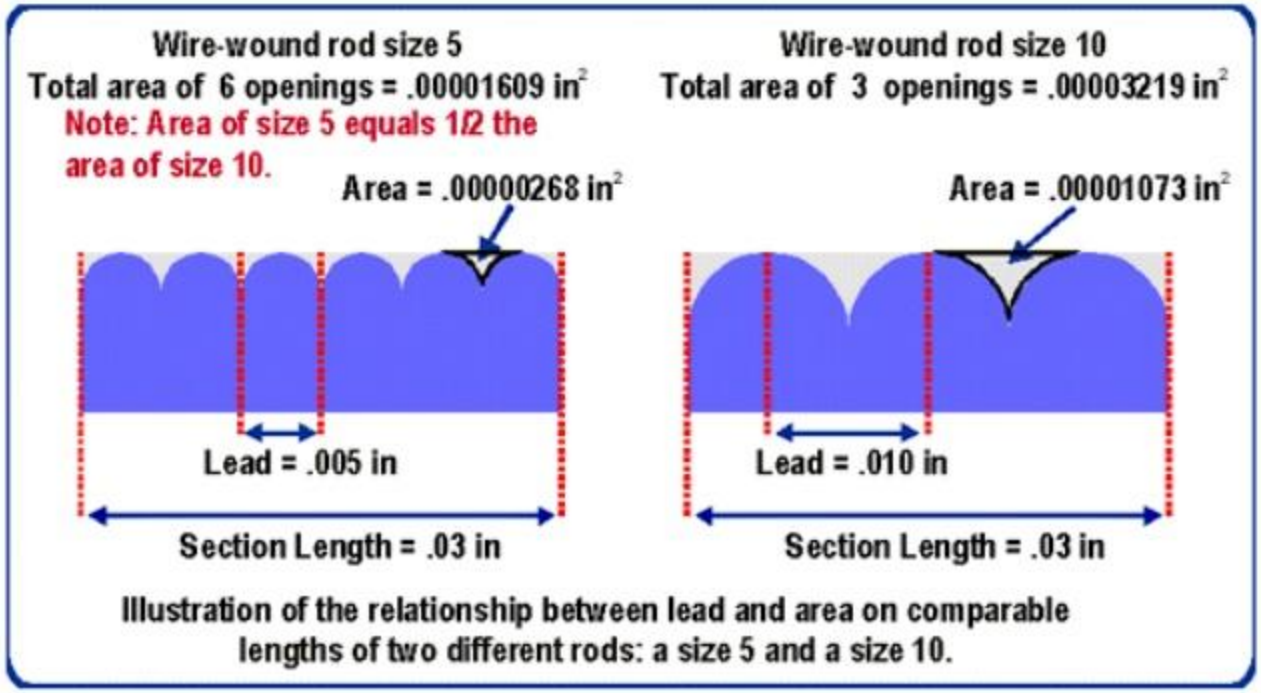

Illustration of the relationship between lead and area on comparable lengths of two different rods: a size 5 and a size 10.

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Figure 1 : Mayer Road Coater

In this coating method, an applicator roll delivers adhesive to the substrate being coated. The applicator roll may turn either with or against the primary web, delivering an excess of adhesive. Wire wound rods are then used to remove the excess. The rods may also turn in either direction.

The amount of adhesive removed depends upon the diameter of the wire which is wound around the steel rod. Coat weight is increased by simply switching to a rod wrapped with larger diameter wire. Two rods in series often give better coating results than a single rod. The first rod has larger diameter wire and removes most of the excess adhesive. The second rod, with smaller diameter wire, smoothes the coating and produces the final desired coat weight. Mayer rod coating can deliver a broad range of coat weights.

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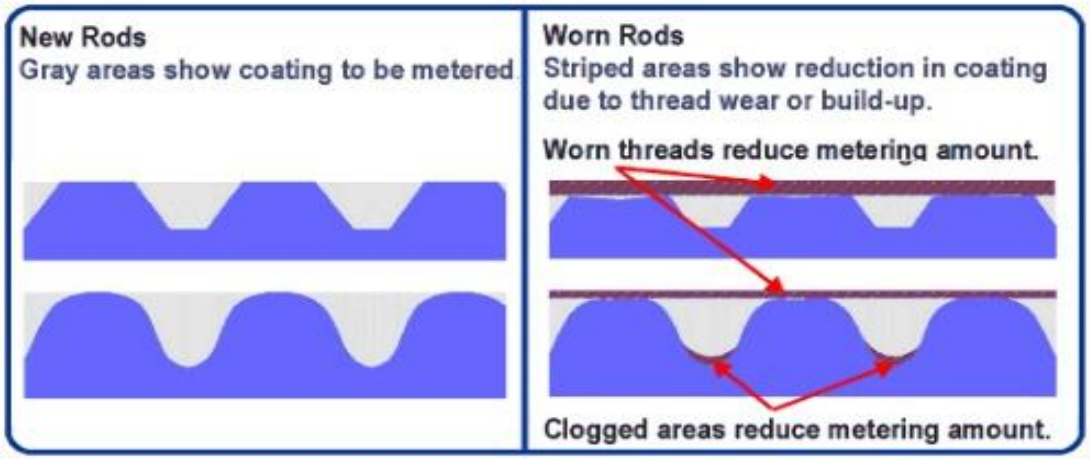

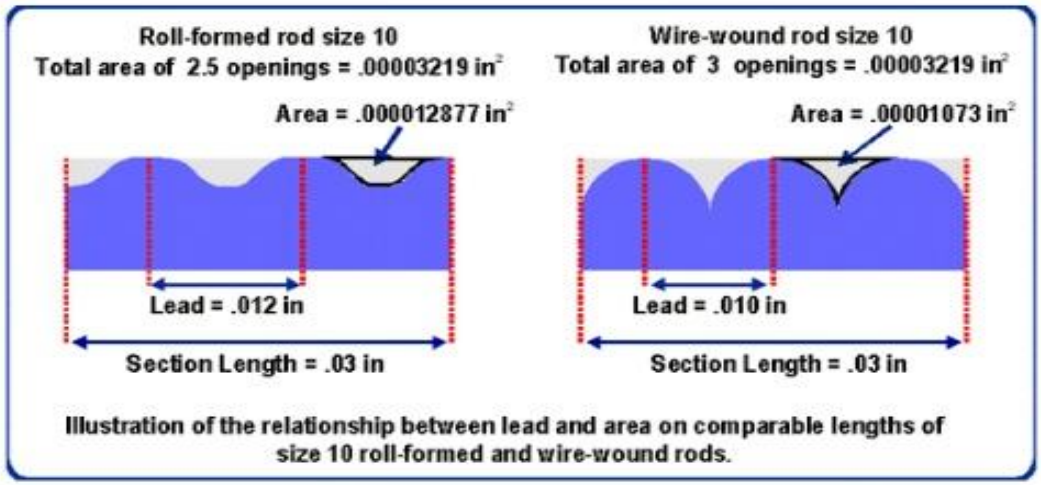

Illustration of the relationship between lead and area on comparable lengths of size 10 roll-formed and wire-wound rods.

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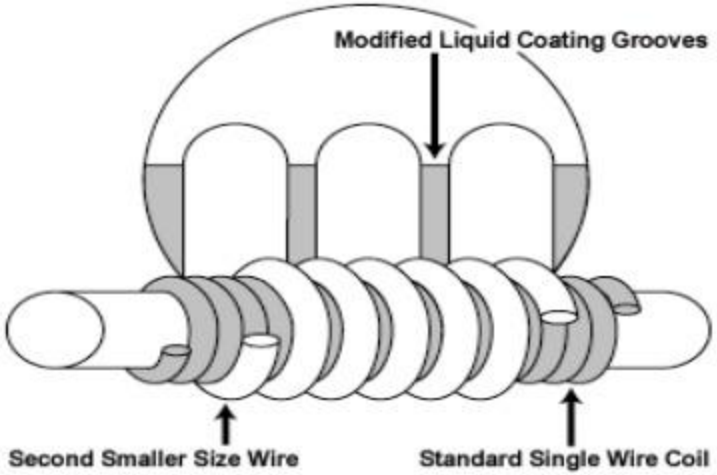
TWO-WIRE DRAWDOWN RODS

Where heavier coatings are required, manufactures provide special drawdown rods with two wires. A standard single-wire rod is over wound with a smaller wire which follows the spiral of the base wire. The result is a modified groove between the wires that will produce wet coatings up to 19 mils (.019") thick.



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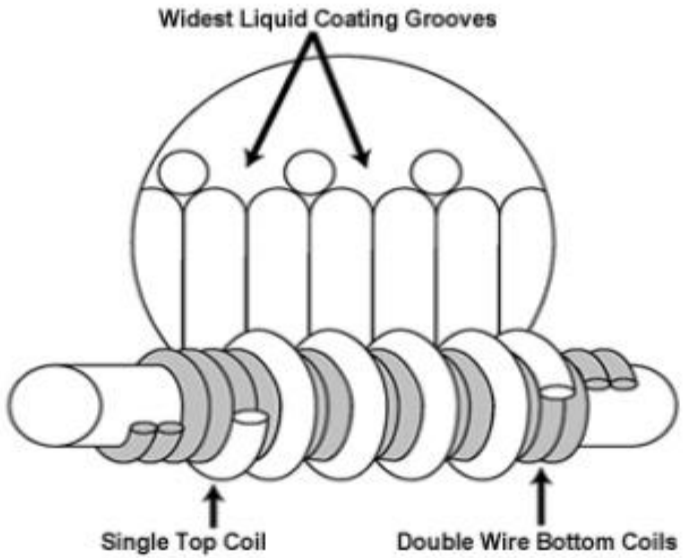
TRI-WIRE DRAWDOWN RODS

Three Rod technology developed by for Coatings up to 56 mils (.056") thick can be produced, using three standard wires wound in a unique configuration.

Two wires are wound side by side on a core rod, then a third wire follows one spiral of the base wires. The resulting groove will maximize the area between the wires, producing a coating more than six times the thickness produced by a single-wire rod!



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Metering Rod Application Chart

	Thickness[1]		Coverage		Wet Film Weight	
Rod #	Mils	Microns	Ft^2/gal	m^2/l	$lbs/1000ft^2$	g/m^2
1	0.15	3.8	10,700	263	0.94	3.8
3	0.3	7.6	5,350	131	1.87	7.6
4	0.4	10.2	4,010	98.4	2.49	10.2
5	0.5	12.7	3,210	78.7	3.12	12.7
6	0.6	15.2	2,670	65.6	3.74	15.2
8	0.8	20.3	2,010	49.2	4.99	20.3
10	1.0	25.4	1,600	39.4	6.23	25.4
12	1.2	30.5	1,340	32.8	7.48	30.5
15	1.5	38.1	1,075	26.3	9.36	38.1
18	1.8	45.7	891	21.9	11.2	45.7
22	2.2	55.9	727	17.9	13.7	55.9
24	2.4	60.3	669	16.1	14.9	60.3
30	3.0	76.2	535	13.1	18.7	76.2
42	4.2	107	382	9.2	26.2	107
50	5.0	127	320	7.9	31.2	127
80	8.0	200	201	4.9	50.0	203
100	10.0	254	160	3.9	62.3	254

[1] 1 in = 1,000 mils; 1 mm = 1,000 microns. Thickness varies somewhat, notably for high viscosity liquids and small wire rods. [2] Lbs/ft^2 assumes 10 lb/gal; g/m^2 assumes 1 g/cm^3; use the following formulas for other densities — wt/ga = 8.312 x specific gravity (density); $lbs/1,000\ ft^2$ = 0.1 x wt/gal x table value; g/m^2 = specific gravity x table

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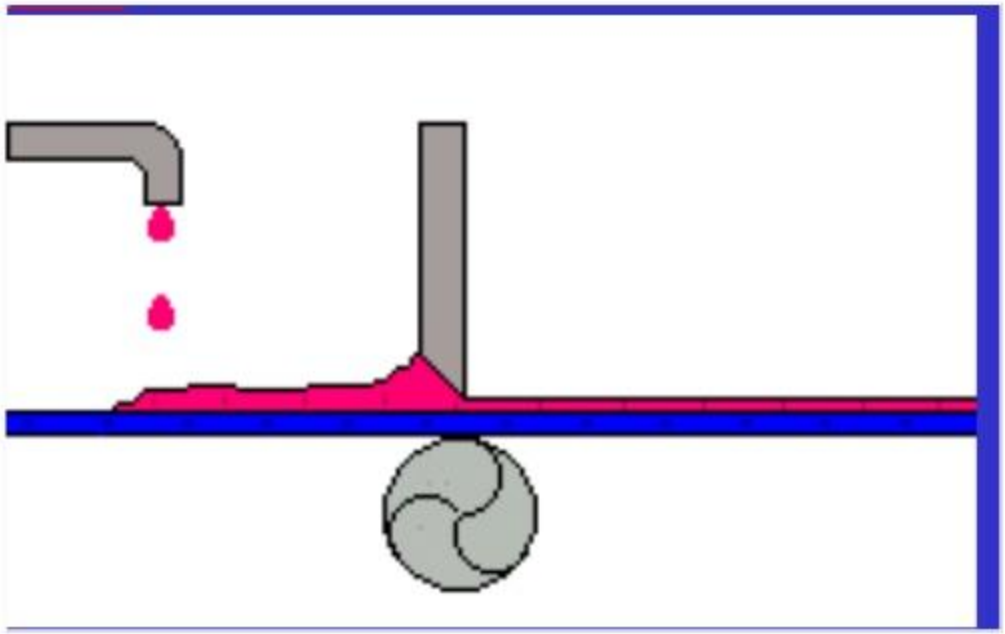
Knife over Roll



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Knife over Roll

This process relies on a coating being applied to the substrate which then passes through a 'gap' between a 'knife' and a support roller.

As the coating and substrate pass through, the excess is scraped off.

This process can be used for high viscosity coatings and very high coat weights, such as plastisols and rubber coatings.

There are innumerable variants of the relatively simple process which is rugged, hard-working and somewhat inaccurate.

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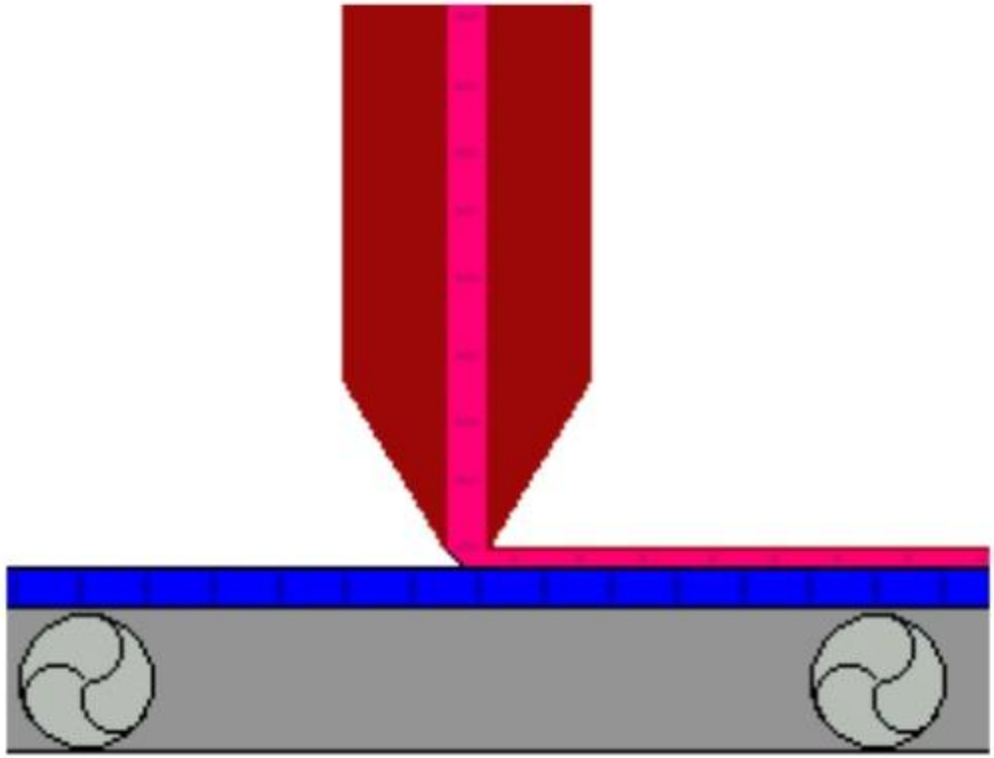
Slot Orifice Coating



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Slot Orifice Coating

In the Slot Die process, the coating is squeezed out by gravity or under pressure through a slot and onto the substrate. If the coating is 100% solids, the process is termed 'Extrusion' and in this case, the line speed is frequently much faster than the speed of the extrusion. This enables coatings to be considerably thinner than the width of the slot.

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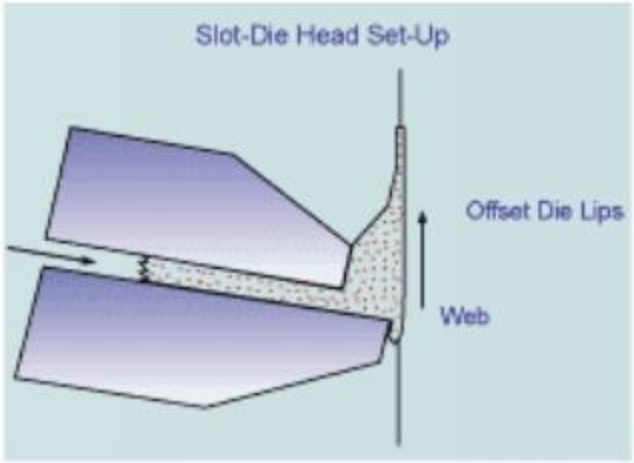
Slot Die Coater

The slot die coater does not use rollers to deliver the adhesive to the web. Instead, adhesive is pumped into a chamber, where it exits through a long, narrow slot directly in contact with a moving web. The web is usually supported immediately behind the slot with a rubber or steel backing roll.

Figure 4 : Slot Die Head Set-Up

The slot die coating method is inherently low foaming, and is capable of producing good quality material at high line speeds. However, the equipment is relatively expensive and requires a high level of operator expertise. Moderate to high coat weights are possible with slot die.



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Die Coating Methods - a family of coating methods:
SLOT-BEAD ("slot", "die", "on-roll slot")
EXTRUSION
TENSIONED-WEB SLOT ("off-roll slot", "TWSC")
SLOT-ON-RUBBER ROLL
SLIDE-BEAD ("slide", "cascade")
SLOT-CURTAIN ("curtain", "hopper", "inverted fountain")
SLIDE-CURTAIN ("multilayer curtain")
JET COATING

Die Coating Characteristics:

Coating process utilizes a "die" applicator for achieving two sequential flows:

internal manifold flow - distributes flow across intended coating width
internal manifold flow is similar for all die coating methods

external transfer flow -transfers the width-distributed flow to the moving substrate
different methods are distinguished by their particular transfer flows

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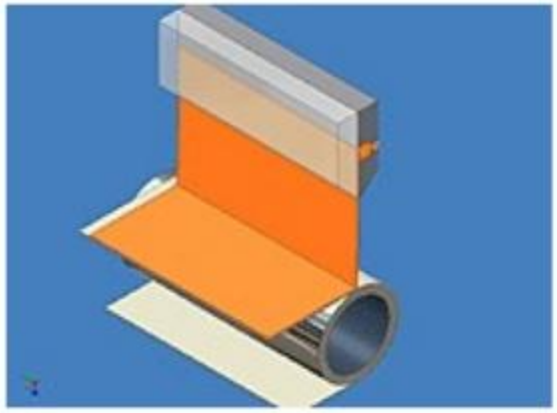

Slot-Curtain Coating section displaying Manifold and Transfer Flows

Slot Die section view displaying internal manifold

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Commercial Advantages

Precision Die Coating allows participation in higher-margin markets exclusive to superior product functionality and more frugal manufacturing (reduced waste, higher productivity) when compared with other coatings methods such as roll, blade, gravure, rod, etc.

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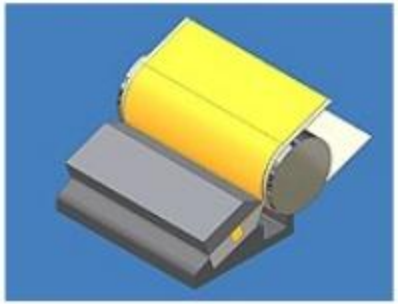
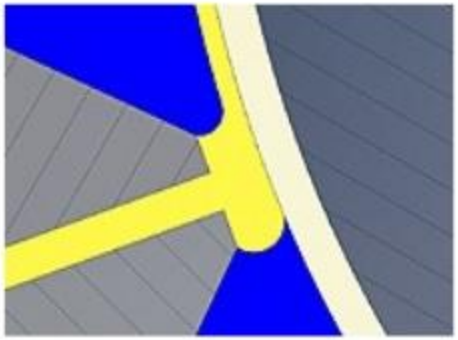


Slot-bead Coating with applied vacuum.



Transfer flow of slot-bead coating

Slot Die section view displaying internal manifold

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Contactless Adhesive Coating

WebFlight adhesive coating technology is a contactless method of applying adhesive coating solutions to web materials by modifying the micro-environment in which the adhesive coating solution and web meet.

WebFlight adhesive coating does not employ rollers, knives, blades, or other contact devices to apply or level coating solutions across the web.

Instead, WebFlight adhesive coating uses the following methods to optimize the adhesive coating process:

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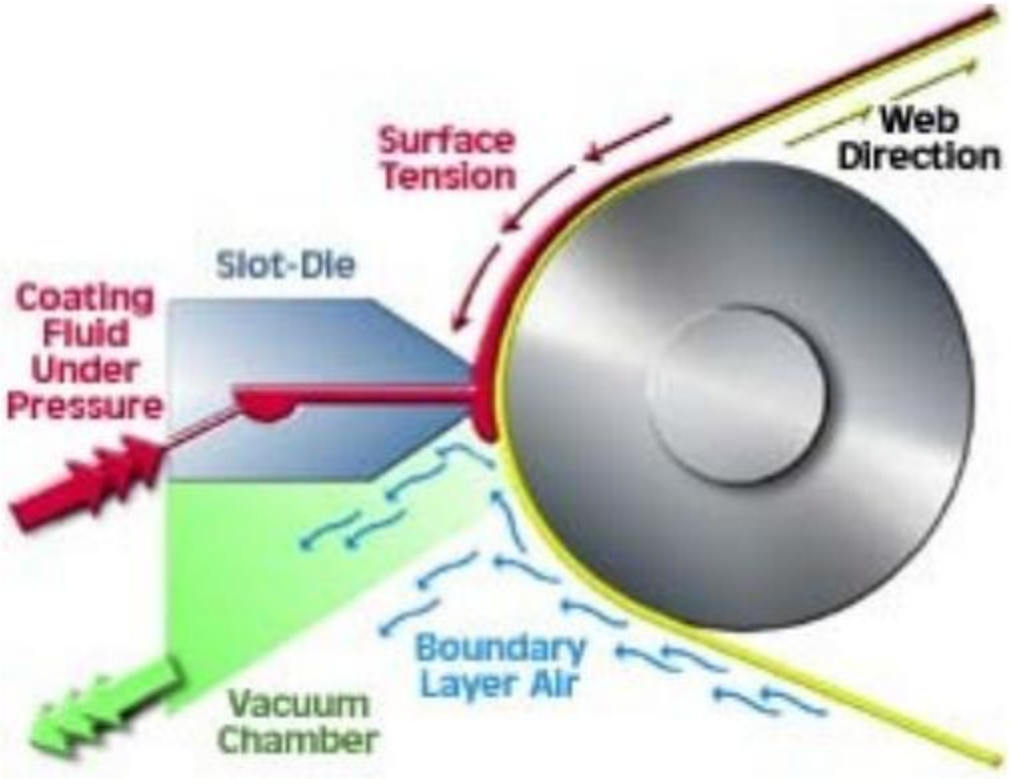
Surface Tension
Web Direction
Slot-Die
Coating Fluid Under Pressure
Boundary Layer Air
Vacuum Chamber

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THANK YOU

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