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Title of Paper: State of the Art Coating Technologies – 5-Roll Coating Method

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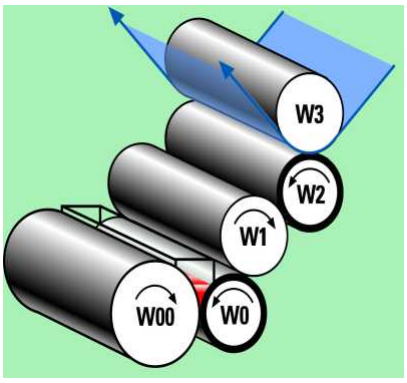
Extended Abstract

In today`s highly competitive converting industry coating systems in multi-roll design are widely used. Various types are in operation depending on the type of application, coat weight and speed.
In order to comply with economics and quality issues roll configurations using the hydrodynamic metering method are in favour. Hereby the most economic solution the renowned 5-roll coating method, introduced by Polytype, allows for achieving of extremely thin and uniform coating layers at high speeds, especially utilized for the application of solventless silicones and for release coats.

The best way to document the outstanding performance of the “5-Roll Coating Method” is to trial it on the high speed siliconizing application. At this speed technology can only comply to the quality parameters with the backup of the right technical solution.

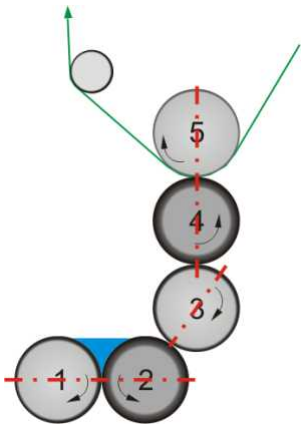
High speed is considered at a production speed greater than 1000mpm (3`300 fpm). At this challenging speed range are only a few machinery suppliers in the market who truly do have the right 5-roll or 6-roll coating head solution available (table 1).



Polytype's 5-roll coating head

W00) chrome plated steel metering roll
W0) Rubber-covered Deflection compensated roll metering roll
W1) chrome plated steel transfer roll
W2) Speedwell (sleeve-type) coating roll
W3) chrome plated steel backing roll

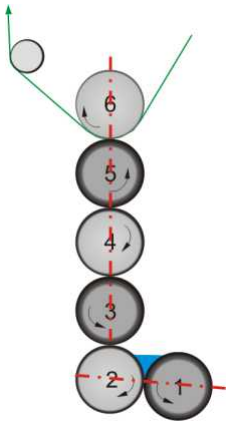
up to 1'500 mpm



"No Name" 5-roll Coating Head

1) Ceramic coated metering roll
2) Rubber-covered metering roll
3) Ceramic coated transfer roll
4) Sleeve-type coating roll
5) Steel backing roll

up to 800 mpm



"No Name" 6-roll Coating Head

1) Rubber-covered metering roll
2) Ceramic coated metering roll
3) Rubber-covered transfer roll
4) Ceramic coated transfer roll
5) Sleeve-type coating roll
6) Steel backing roll

up to 1'610 mpm

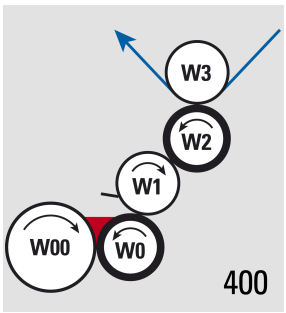
Table 1

By focusing on the parameter "speed" only one will ask why does Polytype`s 5-roll coating head, with its technical solution, allows and achieves what a 6-roll coating head is offering in comparison.

Let have a closer look…

The combination of various unique technical solutions is the reason for this achievement. Among all of those the most important one is the combination of the metering /transfer roll "W0" and the large in diameter metering roll "W00" (table 2).

5-Roll Coating Technology



W3: Steel roll - backing roll
W2: Speedwell (sleeve type) - application roll / 55 shore A
W1: Steel roll - transfer roll
W0: Rubber roll - pressuring roll / 80 shore A
W00: Steel roll - metering roll

Roll #	Speed [%]	Footprint [mm]
W3	100	10-25
W2	~102-105	
W1	~70	
W0	~12	8-20
W00	~1,2	

Table 2

Hereby the design of the roll “W 0” allows for this advantage. The executed feature is called “deflection compensation”. It is a unique technology of Polytype’s parent company and has got a patent on. The roll follows actually the physical deflected contour of the nip (table 3). In combination to this the speed of roll “W0” is isolated form roll “W00” (run on one set speed). This ensures that speed changes introduced to roll “W0” will result in quick, accurate and repeatable coat weight changes. As a result of this a very uniform coat weight profile in CD

Technical Solution –
Polytype’s deflection compensated roll patent

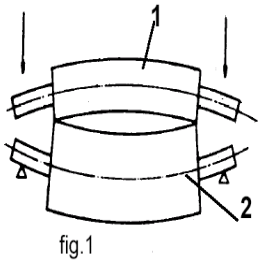


fig.1

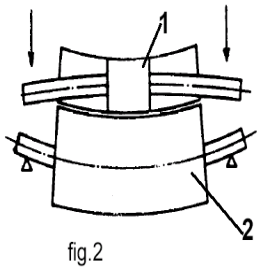
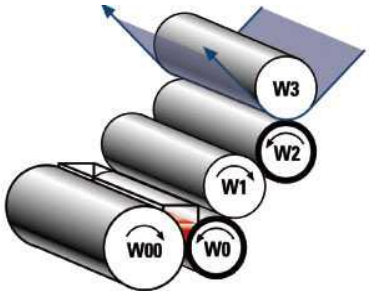


fig.2



Standard Pressure system Normal flexion causes problems for coating quality.	Deflection compensated roll “W 0” The pressure on to the rolls can be guaranteed over the complete length.

1) Metering Roll (W0)

2) Metering / Transfer Roll (W00)

Table 3

and MD direction is applicable.

As one can see by looking at table 1 the NN 5-roll coating head cannot exceed 800 mpm. In comparison all other methods perform just fine.

In order to guarantee operational performance at high speed many technical details had to be incorporate in to the overall design of the 5-roll coating head.

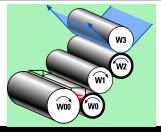
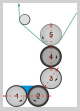
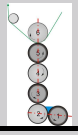
One of the important assembly groups is the silicone mist exhaust system, which ensures based on utilizing of the “air knife” technology that the air/silicone boundary layer travelling with the substrate on the surface at line speed will get broken up and removed.

Conclusion/ Summary

As everybody knows there are always two sides to a coin. There is the theory and there is the practical feasibility proving the performance and the economics resulting out of it.

The theory in its simple form can be used to determine the number of rolls for coating applications with very this films (0,3 to 1,0 microns). One particular question is whether a 5-roll or 6-roll coating system is better for high speed siliconizing release paper. Therefore table 4 summarizes and compares performances of the different high-speed multi-roll coating heads available to converting industry. The choice is there. Now it's up the customers…

Comparison of high speed Coating Methods

Criteria	5-Roll Coating Head (by Polytype)	5-Roll Coating Head (by Competition) *	6-Roll Coating Head (by Competition) *
			
High speed operation (machine speed) (≤ 1500 mpm)	Yes	No ≤ 800 mpm	Yes
Coat weight achievable	0,3 – 3,0 gsm	0,5 – 3,0 gsm	0,3 – 2,0 gsm
Coat weight tolerance achievable	± 0,02 gsm	± 0,05 gsm	± 0,03 gsm
Tempering of rolls (heating/cooling)	5 rolls tempered	3 rolls tempered	6 rolls tempered; thus no temperature changes
Turbulences of the mass in the coating sump	Very low (due to dip blade)	Greater (greater speed roller 2)	Lower
Speed of metering rolls	W0 5-15,0 % W00 2 mpm	2 14,0 % 1 0,6 %	2 10,0 % 1 0,6 %
Deflection Compensated Roll	Yes (W0)	None	None
Silicone misting	Very low due to 2 nips only (less film split)	Greater due to higher circumferential velocity and scraper setting	Lower due to reduced circum-ferential velocity and sleeve technique already at roller 3

* Based on published data in Flexo & Gravure Asia 3-2007

Table 4