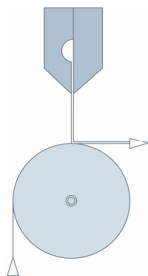


Process Description of Pre-Metered Coating

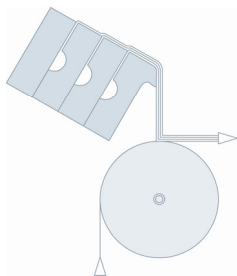
Pre-metered coating methods are a group of technologies which are used for the continuous application of functional fluids on substrate in web format. Unlike the "self-metering" methods, a uniformly operating pump delivers the necessary volume of fluid to maintain the desired wet film thickness on the substrate to be coated for a given working width and at the planned working speed. This fluid quantity is held constant, e.g. by flow control. The coating liquid is then distributed over the desired working width by means of a coating die. For this purpose, a distribution system consisting of a distribu-

tion chamber and a subsequent metering slot is incorporated in the die. The design of this distribution system, in terms of flow technology and the uniformity of the metering slot height, are the key contributory factors to uniform distribution of the fluid across the working width. The coating fluids may contain water or organic or inorganic solvents and for some applications may be used without a solvent (100% solids). As in the case of all other coating techniques, the properties of the fluids must be adjusted to the needs of the pre-metered techniques.

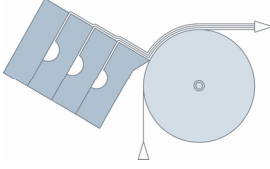
Curtain Coating

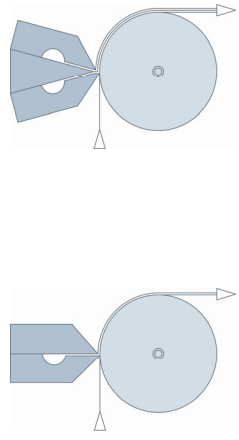


The curtain coating technique enables layers ranging from thin to thick to be applied. The application area ranges from moderate to very high coating speeds, well above 2'000m/min. Curtain coating methods enable one or more fluid layers to be applied in a single operation. The number may exceed ten to suit the particular application and depends on the shape of the coating die (slot die or slide type die). When the curtain coating method is used, the die lip is positioned at a great distance above the web to be coated, the fluid drops downwards in free fall as a closed liquid curtain and is deposited on the substrate.



In the case of the curtain coating method with a slot die, the exit slot is orientated downwards while in applications with a curtain slide die the fluid film leaves the exit slot(s) upwards and then flows down the inclined surface ("Slide") before leaving the die body at the lip and passing into the curtain. Because of the great distance between the lip and web, the curtain coating method is largely unaffected by linear coating defects and produces a very uniform layer on uneven surfaces (contour coating). For this application method too, TSE develops and produces coating dies and also various accessory components which are used to optimize the application window.

Slide-bead Coating	
 <p>The diagram shows a cross-section of a coating die on the left with a substrate web moving from left to right. A fluid film is shown emerging from the die's exit slot, moving upwards and then down the inclined surface of the die lip before bridging the gap between the die lip and the running web.</p>	<p>The slide-bead coating technique enables layers of medium to large thickness to be applied. The application range extends from rather slow coating speeds up to average speeds of 300-400m/min. Slide-bead coating enables one or more fluid layers to be applied in a single pass to the substrate which is to be coated; the number of layers may exceed ten, depending on the particular application.</p> <p>When the slide- bead coating method is used, the fluid film emerges from the exit slot of the die in an upward direction and then flows down the inclined surface ("Slide") before bridging the narrow bead gap between the die lip and the running web– in much the same way as when the slot-bead coating method is used.</p> <p>To achieve the most uniform possible film thickness on the substrate to be coated in cross-machine direction, the parallelism of the bead gap must be set with great precision as must the slot height. An inherently stable and highly accurate positioning system is required. For this purpose, TSE develops and produces coating dies and also various accessory components which are used to optimize the application window.</p>

Slot-bead Coating	
 <p>The top diagram shows a cross-section of a coating die with a substrate web moving from left to right. A fluid film is shown emerging from the die's exit slot and directly bridging the gap between the die lip and the running web.</p> <p>The bottom diagram shows a similar setup but with a different die geometry, illustrating the direct bridging of the bead gap.</p>	<p>Slot-bead coating permits the application of layers which may range from very thin to relatively thick, depending on the particular use. The application area extends from very slow coating speeds of a few cm/min up to medium speeds of 300-400m/min.</p> <p>By means of slot-bead coating techniques, one or more fluid layers can be applied in a single pass onto the web which is to be coated; the number of layers is limited. In the slot-bead coating method, the fluid film leaves the exit slot of the coating die and directly bridges the very narrow bead gap between the die lip and the running web.</p> <p>To achieve the most uniform possible film thickness on the substrate to be coated in cross-machine direction, the parallelism of the bead gap must be set with great precision as must the slot height. For this purpose, an essentially stable and highly accurate positioning system is required. For this application method, TSE develops and produces dies and also various accessory components which are used to optimize the application window.</p>