

WHITE PAPER

Global pilot coating capabilities for the pressure sensitive market



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Introduction

Predicting the release performance of a label construction during medium/high-speed operations is critical for the pressure sensitive industry. As we see coaters and converters continually increasing equipment speeds, we must adapt with these improvements. Suppliers must create silicone release coatings specifically for performance at high coater and converter speeds.

What is driving technology innovation in silicone release coatings? Laminate manufacturers are looking for reduction in energy consumption and carbon footprint in both raw materials and processes, as well as simplified coating processes, decreased scrap waste, and decreased downtime. Multiple key technical challenges must be considered in any silicone release coating development, as the material must do many things well simultaneously to meet processing and performance needs. Additional requirements on the silicone release coating performance come with increased coater line speeds.

From food and healthcare to graphic arts and labels, **SYL-OFF™ Silicone Release Coatings** from Dow consist of a range of technologies to deliver the right solution for any application. This document will help you discover the many ways Dow can help you overcome your release coating challenges with global coater capabilities and resources available. We are with you throughout every step of the process—from choosing the right silicone release coating formulation and selecting the right equipment and coating technique for your substrate, to achieving success in your end-use applications. Dow will help you release the potential of silicone performance.

This white paper introduces our **global coater resources in North America, Europe and China** which enable us to develop new solutions and evaluate current solutions used in the market on a variety of substrates and with differing chemistries, including solventless, emulsion, solvent-based release coatings and pressure sensitive adhesives.



North America (NA) pilot coater and laboratory

Our NA Dow Central Campus enables product development and technical service teams to collaborate closely to meet the challenges and demands within the pressure sensitive market and identify solutions quickly using our siliconizing coater and adhesive coater. Having both these technologies in one location, **Dow can produce tailor-made solutions for both siliconizers and laminators, who are typically looking for higher efficiency and productivity.** To coat different types and gauges of paper and filmic substrates, our NA silicone three-roll offset gravure coater has the following capabilities:

Temperature range	27 -204°C (80 -400 F)
Speed range	15 -91 m/min (50 - 300 ft/min)
Dwell time	1.2 -7.2 s
Coat weight	0.6 -1.9 g/m ² (0.4 -1.2 lbs/rm)
Web width	25.4 -40.6 m (10-16 in)
1.8 m (6 ft) forced air ovens	
Corona treater (mainly used in filmic applications)	
Release coating system: Solventless	

With this coater, Dow has continually innovated around market trends and produced an extensive product line for meeting individual product needs. **After each run on the coater, the Dow team can quickly analyze the quality and performance of the coating using our state-of-the-art testing lab.** Within five minutes of silicone coating completion, application testing, including cure, anchorage, and coverage, can be completed to determine next steps and optimize formulation. Also, as the chemistry determines, we have strict protocols around aged application testing to determine aged performance of the silicone release coating up to six months. Our team can quickly determine optimal oven temperature, exit web temperature, and dwell time on specific substrates, which in turn minimizes cure catalyst levels and supports energy savings and sustainability.

Dow adhesives can also be coated on liners that utilize our system, using our adhesive coater which has Forward and Reverse gravure capabilities to vary coating technique and coat weights. With this coater, we can run off hundreds of feet of laminate per formulation for initial and aged performance evaluation. This system includes waterborne acrylic adhesives and silicone release coating emulsions, and the coater has the following capabilities:

Temperature range	27 -204°C (80 -400°F)
Line Speed	3.0 -91 m/min (10 -300 ft/min)
Dwell time	3 -90 seconds
Coat weight: Adhesive	16 -25 g/m ²
Web width	0.25 -0.46 m (10 -18 in)

With the constantly changing raw materials, i.e., substrates (thinner gauge, varying composition, porosity), adhesives, and facestocks in the pressure sensitive market, this coater enables us to react quickly in this dynamic environment to identify potential solutions that meet market trends and customer needs. Innovation never stands still, and **our coater and testing resources help us quickly align to the needs of the pressure sensitive market.**

Beyond the typical requirements, the biggest additional challenge resulting from increasing coater speeds is mist control. Misting has been a longstanding industrial issue but has increased in focus as coater speeds continue to increase. Mist can lead to problems such as downtime and higher maintenance costs. The challenge for silicone suppliers and coater operators is to control this misting, particularly at speeds over 1,000 meters per minute. Mist forms as the film splits between two rolls in the coating head as the coating is transferred from one roll to another in a multiroll configuration. Formation of liquid ribs occur in the nip across the width of the coater rolls. Filaments of silicone form under high coater speed due to the high shear between the counter-rotating rolls. As the coater speed increases, shear thinning of those filaments accelerates in milliseconds. Rapid breakup at multiple points of those filaments creates aerosolized silicone mist. Mist forms for all coatings at a certain line speed; the faster the line speed, the more likely mist is to be generated. Mist generation can be significantly reduced through use of silicone additives and optimized machine conditions.

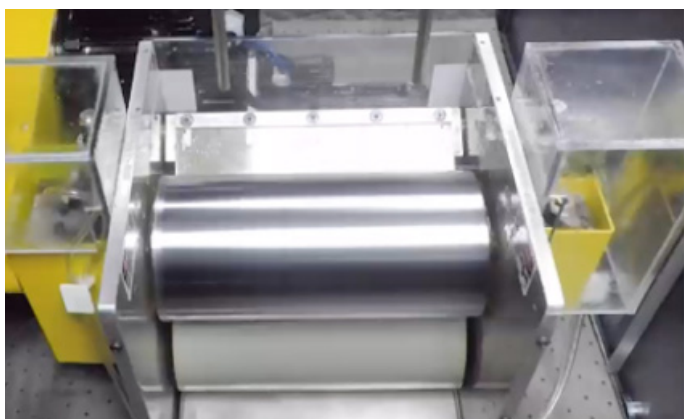
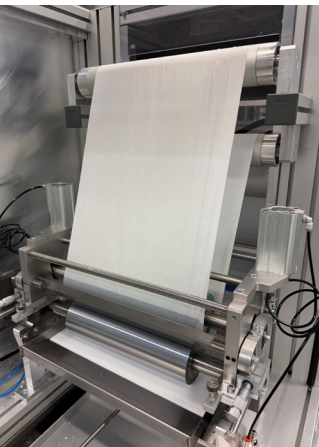


Figure 1: Lab demonstration of mist control additive (on the left) compared to the same silicone formulation run at the same speed with no mist control additive (on the right).

Several challenges are posed by misting. Coaters can experience significant downtime when droplet deposition must be cleaned from equipment. Any material lost to mist is not available to coat onto the substrate. As the web carries mist upward, dust accumulation in the curing oven can reduce heat transfer efficiency. Dust accumulation also creates the need for coater downtime for oven cleaning. These effects can cause defects, cleanliness issues, industrial hygiene concerns, and potential adhesive contamination in addition to downtime and material loss. **We are able to evaluate solutions for up to 1,300 m/min using the above equipment.**



Europe pilot coater and laboratory

In 2023, we acquired a **new pilot coater in Belgium with up-to-date coating technology.**

The VCML is a **precision engineered coating machine, designed to coat flexible webs**, including many different types of paper and films on a reel-to-reel basis with the ability to apply a wide range of coatings (both as 100% solids and as water-based dispersions). Due to the modular nature of the coating head drive, **we can use a wide range of coating head technologies.** Along with its small scale, the flexible nature of the VCML makes it **particularly interesting for evaluation of new innovations, new product development, and quality investigations.**

The single-side supported web allows easy access for quick replacement of base paper/film and coated rolls. The VCML is also fitted with a corona discharge head for pre-treatment of substrates prior to coating and a lamination station along with additional unwind for lamination of adhesive coated materials (against silicone release liner if needed).

Technical capabilities:

Air temperature range	50 – 200°C (122 – 392 °F)
Speed range	1 – 50 m/min (3 – 164 ft)
Standard material requirements	300 mm (12 in) maximum web width, 310 mm (12.2 in) maximum reel diameter, 76 mm (3 in) core.
2 x 0.9 m air impingement ovens – (11 adjustable nozzles, pneumatic opening, delivering 250 m ³ /hr air through 11 kW heaters).	

Emulsion silicone coating

Coating techniques:

- Direct plain roll for porous substrate such as food release base paper
- Reverse direct gravure for treated base paper such as glassine or filmic substrate or PET

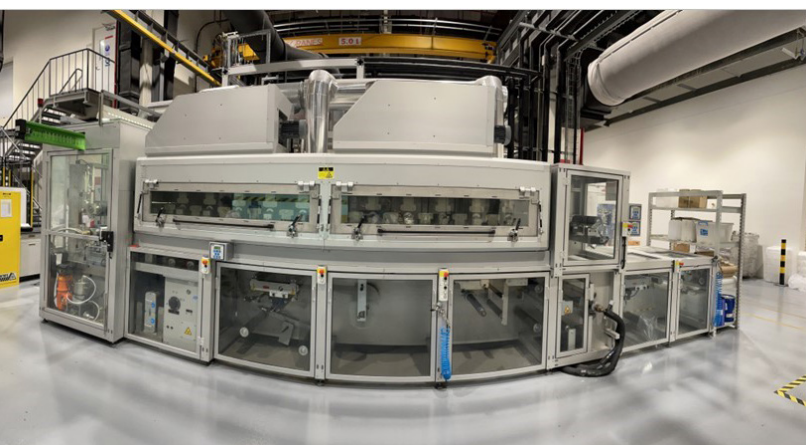
Typical speed	15 m/min (50 ft/min)
Typical air temperature	170°C (340 °F)
Dry coat weight	0.1 - 1.0 g/m ²

Solventless silicone coating

Coating techniques:

- Indirect gravure for coating of a wide range of base papers and films

Typical speed	10 m/min (33 ft/min)
Typical air temperature	170°C (340 °F)
Coat weight	1.0 – 1.5 g/m ²



China pilot coater and laboratory

To align to global market trends while covering regional needs, **our China pilot coater provides multi-functional coating capabilities for both silicone release coatings and silicone PSAs.** The systems range from solventless and waterborne emulsions to solvent based. With such capabilities, **Dow can meet different requirements, speed up innovation and provide fast response and solutions,** reflecting Dow's customer-centric and innovation-driven core values.

The pilot coater details:

Dimensions	8525x1814x2962 (mm)
Temperature range	~200°C (392 °F)
Speed range	1~100 m/min
Functions	lamination, surface treatment (corona)
Capable coatings	<ul style="list-style-type: none">• Silicone release coating covers solventless, solvent-based and emulsion.• Silicone PSA covers solventless, solvent-based and emulsion.

Our China pilot coater is capable of **simulating processing conditions**, including high line speed with short dwell time, different coating weights and different substrates like PEK, glassine, CCK, etc. In addition, it is **designed with capacity to coat on film** with solvent-based release coatings, especially for high-end filmic applications like release films on OCA, MLCC, protective films, etc. The film substrates can be PET, PE, PP, etc.

The China pilot coater can also be used to coat silicone PSA, both solvent-based and solventless of different thicknesses; the substrate can be PET, PI etc. It not only provides traditional tape application solutions but also provides innovative solutions, including silicone OCA, protective film, etc.

Conclusion

Together with partners, Dow not only provides sustainable solutions but also expertise as the leader of innovation in the pressure sensitive industry.

We have intentionally positioned both solventless and emulsion coating resources globally to fit with our sustainability aims of moving towards these delivery systems as alternatives to solvent-based systems. Above is a summary of our capabilities. **We have the capacity to quickly evaluate many substrates and silicone solutions under varying conditions to keep pace with ever-changing customer and industry needs from a productivity and sustainability perspective.**



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