WHITE PAPER

Appealing surfaces of coil coatings

Evonik Resource Efficiency

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A FAST-GROWING MARKET, ESPECIALLY IN ASIA PACIFIC:

Coil coatings are well-known in the market for providing high quality at low overall cost to end-users [1]. The transfer efficiency of the roller application is one of the major reasons for its popularity. Over the last few years, the Asia-Pacific region has surpassed Europe as the leading consumer of coil coatings [2].

Pre-coated aluminum and steel coils applied by a roller-coater are a very economical way to create color-coated goods without using a paint shop. Along with architectural elements (facades, roofs) and consumer goods (furniture, washing machines), food containers like cans are in the focus for such an application. The expected demand for coil-coated substrates will increase by more than 7 % annually in Asia-Pacific [2]. There are three major reasons for this above-CAGR increase:

- The roller-coating application process is very effective; it is almost completely free of over-spray, so very little coating is wasted. The high line speed allows for a high output during production.
- Thermal combustion systems are state-of-the-art for solventborne coatings. No air-polluting solvents are released into the environment, and the energy of the combustion is used for heating up the curing oven for the roller-coater. This system allows for high throughput combined with an environmentally friendly and resource-efficient application process. This leads to an overall reduction in emissions at work sites.
- After application and curing of the coating, the coated substrates will be coiled, stored, or shipped for an extended period of time. When necessary, the substrate can be wound up, cut, drilled, and bent into the desired shape and into the desired amounts. This is a much more flexible means of production than, for example, a process involving casted iron, where the ready-made shape can only be sprayed and cured with a lot of overspray, drying time, etc. All of these factors lend to a production rate lower than that of the roller-coater process, where just one coating facility added to the beginning of the economic value chain can serve hundreds of metal-working facilities efficiently.

Increasing quality demands for coil coatings

Because of extended warranties for long-lasting products like house paneling, roofing, and windows, the producers of coil coatings are faced with increasing quality requirements leading to improved optical quality of the coated surfaces. The high line speeds of these industrial band coating operations and the subsequent deformation of the coated sheets demand extraordinary requirements regarding the optical appearance of coil coatings. They must provide excellent leveling, be free of foam and bubbles, and have surface characteristics such as smoothness, scratch resistance, and abrasion resistance.

TEGO® Flow additives provide excellent optical appearance

Polyacrylates are well-established as flow additives for coil coatings. By their chemical nature, they are stable to the high curing temperature in the coil coating process. They impart smooth surfaces properties immediately after the coating is applied. Because the surface energy of the dried coating is not reduced, the wetting properties of the subsequent layer are not critical, making them very suitable for multi-layer coatings [3].

TEGO® Flow 375 and **TEGO® Flow 460 N** are new, silicone-free flow and leveling additives specifically developed for use in solventborne can and coil coatings. The backbone of both products is based on unique and reliable polyacrylate chemistry, providing excellent recoatability for usage in, for example, primer/topcoat systems or lithographic images. To meet current and future demands regarding health and the environment, neither product contains any aromatic solvent like xylene, toluene, or higher aromatics. Additionally, neither halogens, formaldehyde, nor BPA are contained in the compositions.

TEGO® Flow 375 has an excellent broad binder compatibility for universal use in coil and can coatings. This leads to an outstanding optical appearance with no haze in the cured system, especially for transparent applications. This effect is demonstrated by the following lab results:

Table 1: Improved optical appearance via flow promotion

Properties	Formulation* without additive	Addition of 0.4% TEGO® Flow 375 to the formulation*
Gloss @ 20°C	96	96
Appearance in liquid formulation	clear	clear
Long wave	17	6
Short wave	30	8

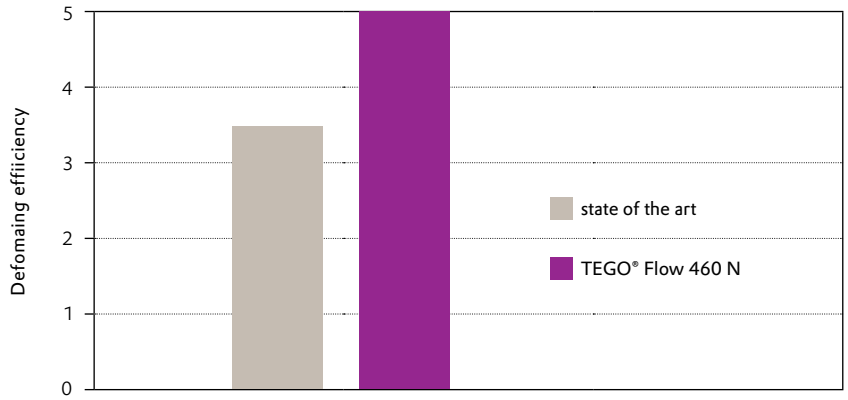
*Testing system based on Polyester (DYNAPOL® LH 831-24)/ Melamine

Image 1: Excellent flow promotion by addition of 0.4% TEGO® Flow 375 to the formulation*, applied by spin coater

*Testing system based on Polyester (DYNAPOL® LH 831-24)/ Melamine

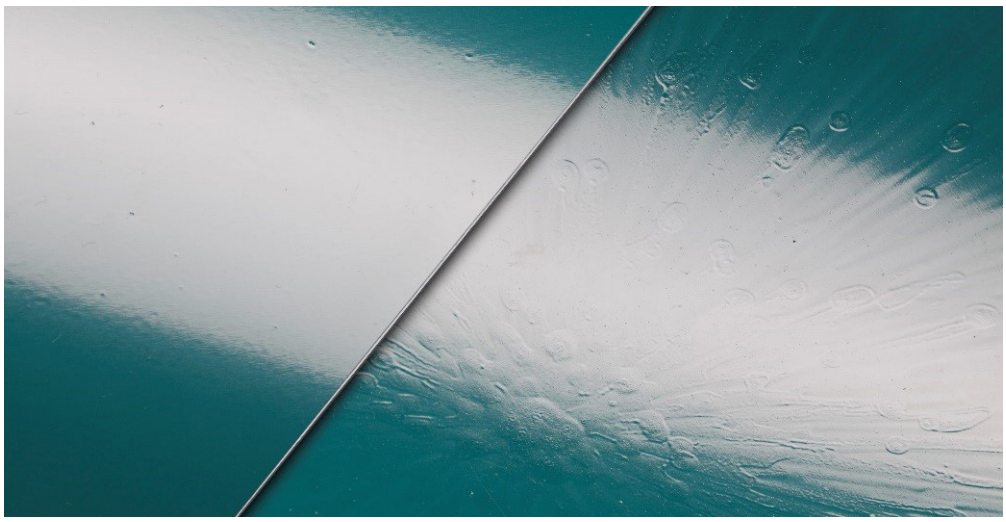
TEGO® Flow 460 N provides flow improvement as well as an additional deaerating effect. Due to its relatively hydrophobic nature, it avoids entrapment of foam during application. This additive was developed for use in pigmented systems. Achieving these two important properties for can and coil coatings reduces complexity. This effect is demonstrated by the following lab results:

Diagram 1: Improved defoaming properties in the formulation*



*Testing system based on Polyester (DYNAPOL® LH 831-24)/ Melamine [4]

Image 2: Excellent optical appearance via improved defoaming properties by addition of 0.4% TEGO® Flow 375 to the formulation*, applied by spin coater



Neither of the new flow additives will influence the pigment stabilization in solventborne can and coil coatings during manufacturing, storage, or application.

OUTLOOK: FURTHER INCREASE IN OPTICAL REQUIREMENTS

Demands made upon the surface appearance of the bake-cured enamels are constantly increasing. The goal for the future is to create Class A surfaces via the roller-coating process. Currently, Class A surfaces can only be created via spray bell or spray gun application. Therefore, high-gloss surfaces for premium goods (such as cars or consumer electronics) cannot be attained by a roller coating process. Next to the orientation of metallic and effect pigment particles, the most important factor for Class A surfaces is the visual appearance of the coated surface. Only smooth surfaces with a very low short wave and long wave haze provide a surface suitable for premium goods. Both additives can be used in coatings formulations to optimize long wave/short wave up to 80 %! This enables coatings producers to follow the global trend of premium optical appearance.

FAR-REACHING LISTING AND REGISTRATION AROUND THE GLOBE

Due to global demands of coatings producers and applicators, it was decided at a very early stage of product development that global listing is absolutely necessary to support customers and end-users needs. Both **TEGO® Flow 375** and **TEGO® Flow 460 N** are listed in all major chemical inventories for universal use (EINECS, TSCA, DSL, ENCS, AICS, ECL, PICCS, IECSC, TSCI, NZIoC) and fulfill the 21 CFR FDA regulations 175.300. Also, all components are also listed in Annex 6 in the lists for evaluated (A) or not evaluated (B) substances according to Swiss Ordinance (SR 817.023.21). These universal registrations minimize the complexity for coatings manufacturers in handling, logistics, and formulation and allow diversified application. This means coatings manufacturers can use the same additive for more diverse end-uses like roof-toppings or food cans.

SUMMARY

End customers' decisions are ultimately determined by quality and high demand for excellent visual appearance. The new surface additives improve processing and visual appearance significantly. In solvent-based can and coil coatings, such specially developed polyacrylates provide excellent appearance. The products' composition and their far-reaching listings and registration leads to universal application. Recoatability is excellent, due to the fact that they do not impair the surface energy of cured films. Both new additives fulfill 21 CFR FDA regulations 175.300, and all components are listed in Annex 6 in the lists for evaluated (A) or not evaluated (B) substances according to Swiss Ordinance (SR 817.023.21).

- **TEGO® Flow 375** shows a broad compatibility with all binders and high optical transparency.
- **TEGO® Flow 460 N** provides flow improvement as well as an additional deaerating effect.
- Both products are free of hazardous ingredients like BPA, aromatics, and halogens.

The excellent optical appearance attracts can and coil coating customers worldwide.

REFERENCES

[1] 2015 IHS Chemical Economics Handbook | Paint and Coatings Industry Overview

[2] KNG 2014 Global Paint & Coatings 2013–2018

[3] http://www.tego.de/sites/dc/Downloadcenter/Evonik/Product/Tego/en/Technical-Background/slip-and-flow-additives,-radiation-curing-additives.pdf

[4] http://www.dynapol.com/sites/lists/RE/DocumentsAC/DYNAPOL-for-can-coating-EN.pdf

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