Smooth ink transfer through ultra-hard surfaces

The laser-engravable TeroLux anilox roller coating made of ultra-hard tungsten carbide significantly increases the product quality in flexo printing

Andreas Willeke, Managing Director of TLS Anilox, with a highly polished TeroLux anilox roll ready for laser engraving

Source: TLS Anilox

Andreas Willeke

Often innovations are a result of creative troubleshooting. In the field of ceramic anilox rollers for flexo printing, there are several key issues such as scoring, dirty lines, wear and tear, vulnerability to surface damage, high cleaning efforts, reduced ink transfer, ghosting as well as low cell volume at high screen rulings.

The TeroLux anilox roller coating developed by German company TLS Anilox GmbH consists of a layer of tungsten carbide-based hard metal. This mixture of tungsten and carbide is an extremely hard and very dense metal that is thermally applied to the body of the anilox roller by means of the high-speed velocity flame spraying (HVOF) process. After finishing this sprayed layer it gets engraved using a special laser provided with accordingly adapted laser optics.

From the original idea to the final market maturity in 2015, TeroLux was developed over the course of eight years. During this time, a broad variety of powder mixtures, grinding and polishing processes were used and new approaches in laser technology applied. The results achieved were subjected to tough long-term trials and field tests at two selected flexo printing plants. However, according to TLS Anilox, this costly and lengthy development efforts proved well worth, as TeroLux provides users with an anilox roller coating of exceptional quality and with unique properties.

Such properties include surface hardness of up to 1400 HV, porosity below 0.5% and a very high density of 15.1 g/cm3. By comparison: Lead has a density of 11.34 g/cm3.

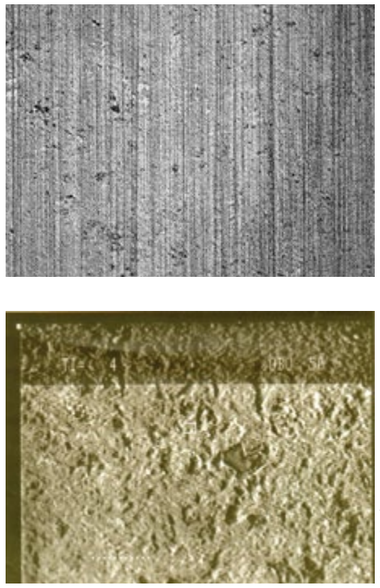
Application advantages and service life

The combination of extreme hardness comparable to chromium, very low porosity and high density makes tungsten carbide very suitable as a coating material for anilox rollers. The application advantages compared to ceramic coated anilox rollers include:

- Up to 20% higher ink transfer and ink density
- Prevention of dirty lines on the roller
- Reduction or almost elimination of scoring
- Reduced cleaning efforts at intervals of up to eight months
- Significantly improved even ink laydown
- Low wear of doctor blades
- Extremely flexible 60° engravings
- Significantly improved productivity and print quality
- Very fast return on investment (ROI)

Compared to the TeroLux coating, the usual ceramic layer shows significantly coarser surface structures. (figure 2) This is due to the high residual porosity of the ceramic material, as these pores may be up to 15 microns wide and 5 microns deep.

Of course, TeroLux coated anilox rollers are also exposed to the risk of mechanical damage. Particularly when cleaning them with liquid media, attention must be paid to the metallic and thus corrosive character of the coating. Therefore, only aluminum-friendly cleaning fluids should be used. TLS Anilox estimates that the service life of properly treated TeroLux anilox rolls is at least four years.



Microscopic comparison of highly polished surfaces ready for engraving: TeroLux coating (top) and ceramic coating (bottom)

Source: TLS Anilox

Technical advantages

During a laboratory test conducted by a manufacturer of flexo presses, the print quality achieved under identical conditions with seven different anilox rollers were compared. The specification of the rollers included screen rulings ranging from 420 to 550 l/cm and cell volumes of 3.2 to 4 cm3/m2. As can be seen in figure 3, anilox roller No. 7 coated with TeroLux with a screen ruling of 500 l/cm and a cell volume of 3.6 cm3/m2 showed the lowest dot gain while delivered the highest ink density.

Figure 4 shows the results of a print test performed by another press manufacturer. For this a TeroLux banded anilox roller with 60° hexagonal engravings and the following screen rulings and cell volumes was used:

- 500 l/cm; 4 cm3/m2
- 400 l/cm; 6 cm3/m2
- 300 l/cm; 8 cm3/m2
- 200 l/cm; 10 cm3/m2.

The screenings on the flexo printing plate (60, 54, 48 and 42 l/cm)

„The TeroLux anilox roller achieves surface hardnesses of up to 1400 HV and a porosity of less than 0.5%."

were chosen according to the respective screen ruling of the banded anilox roller. As can be seen, all four tonal gradient of the test form are printed out very cleanly from the full tone area to the smallest dots. Furthermore, no moiré and no hard tear edges or over-inking of even the smallest dots occurs.

Figure 5 shows the hard tear edge at runs towards 0% at screen rulings of 60 l/cm and dot size of 0.4%. The print test also proved, that types line and full tone areas were also printed cleanly, evenly and with very high ink density.

Process advantages

- **Improved ink release properties and less cleaning efforts**

The optimised cell geometry with flat bottoms and the very homogeneous surface of the TeroLux rollers minimise the physically effective adhesion forces. This results in significantly improved ink release properties and reduces ink drying in the cells. Therefore it is quite sufficient to rinse TeroLux anilox rollers with a slow-volatile solvent filled into the doctor chamber. With proper handling, intervals of up to eight months are sufficient for roller cleaning in an external facility.

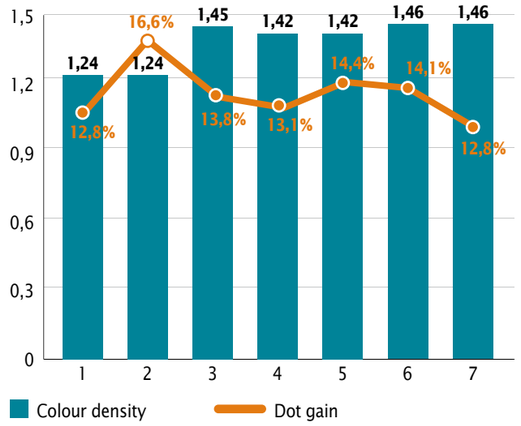
- **Less wear of doctor blades**

Due to the very smooth cell walls, the doctor blade runs on a wear-reduced surface. The hardness, density and microporosity of less than 0.5% of the TeroLux coating eliminates cell wall damage and thus the formation of scoring lines caused by to the settling of tiny metal particles between the doctor blade and the roll surface. Therefore, doctor blade steels of the highest quality and special plasma spray ceramic coated doctor blades can be used even for the finest screen rulings. This also has a positive effect on productivity in white printing and printing with a fixed colour gamut (ECG/Extended Colour Gamut).

- **Very fast ROI**

Compared to ceramic-coated anilox rollers, the production costs of TeroLux anilox rollers are very high, which naturally also affects the pricing of these products. Such high investment costs are often a deterrent for potential users. But according to TLS Anilox, these higher costs are more than compensated for by potential savings, better print quality as well as higher productivity and availability. Against this background and depending on the respective application, the investment may pay for itself within just eight weeks.

Comparison of ink density to dot gain for a 3% dot



Source: TLS Anilox

TeroLux anilox roller No. 7 shows the lowest dot gain while delivering the highest ink density

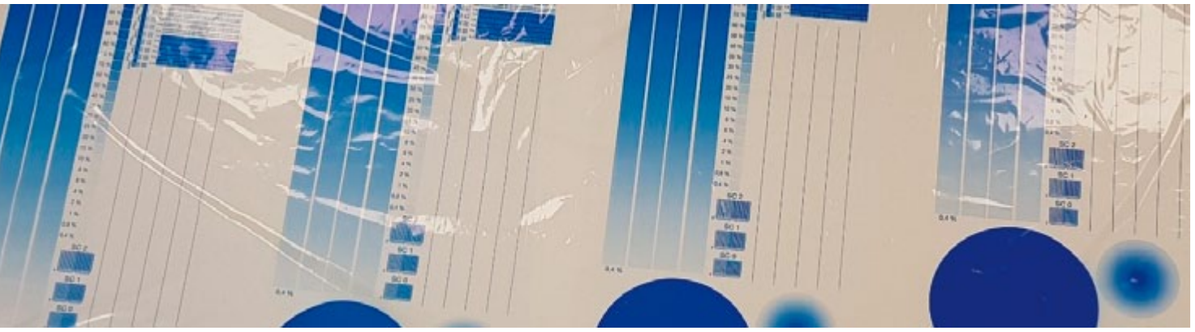
Innovative anilox rollers for customised applications

TLS Anilox GmbH, based in Salzkotten near Paderborn in Germany, was founded in 2014 and is managed by Andreas Willeke. The company is a member of the TeroLab Surface Group, which in turn belongs to the TeroLab Holding based in Lausanne, Switzerland. Its president, Christopher Wasserman, has been dedicated to the field of thermal spray coating for decades and is always on the lookout for process-promoting innovations. In this respect, he also founded the "René Wasserman Award", which has been awarded every three years since 1999.

Source: TLS Anilox

The TLS Anilox premises in Salzkotten near Paderborn, Germany

The core competence of TLS Anilox GmbH is the production of coated and laser-engraved anilox rollers and anilox sleeves for the printing and coating industry. The company benefits from extensive experience in the fields of flexo printing and special varnishing in offset printing. In addition, requirements for special applications are also met, such as decorative printing or coatings. TLS Anilox's commitment to product innovation is also reflected in its active participation in various research and development projects.



Source: TLS Anilox

Detail of a print test performed with a TeroLux banded roller with various 60° hexagonal engravings

Cost savings in white printing

According to one of TLS Anilox's customers, they use a TeroLux anilox roller with a cell volume of 15 cm3/m2 for jobs that previously required two printing units provided with anilox rollers with a total cell volume of 22 cm3/m2. This resulted in total ink savings of 33%. Added to this is the reduced external cleaning effort at eight-month intervals. The savings in ink consumption alone led to a payback of the anilox roller within just eight weeks. Further cost savings were achieved through the elimination of a complete inking unit and the associated expenses for plate production, make-ready, doctor blades and a second anilox roller.

Cost reduction with HD halftone printing and ECG

The very high screen rulings between 340 and 600 l/cm required for HD halftone printing as well as for printing with a fixed colour palette. In this regard, the brittle, rough and porous structure of ceramic surfaces has adverse effects. Not only does this cause ink to be retained in the cells, there is also the risk of particles splintering off the cell walls, which in turn leads to the formation of score lines. Therefore, anilox rollers with very high screen rulings usually have to be refurbished or replaced after 6 to 18 months. In contrast, TeroLux anilox rollers with 500 l/cm are sometimes in use for up to four years with virtually no wear. Therefore it is not surprising that the majority of these anilox rollers are used for HD halftone printing. Among other things, printing with a fixed colour palette noticeably contribute to reduce costs for make-ready costs in ink consumption. With the TeroLux anilox rollers, even very large print-runs can be executed with consistent quality and colour intensity and without interruption caused by cleaning measures for plates or anilox rollers. This results in true productivity gains.

Higher productivity through greater flexibility

The TeroLux engraving specification of 400 l/cm, 60° hexagonal and cell volume of

6 cm3/m2 was also used to print the subject shown in figure 4. This allows jobs combining solid areas, fonts and technical screens of up to 54 l/cm to be printed separately and/or together. In addition, considerable colour depths can be achieved in combination with screened printing

"Currently we run five flexo presses of three different types from Windmöller & Hölscher, all of which now equipped with TeroLux anilox rollers."
– James Chrichton, Amcor Moorabbin –

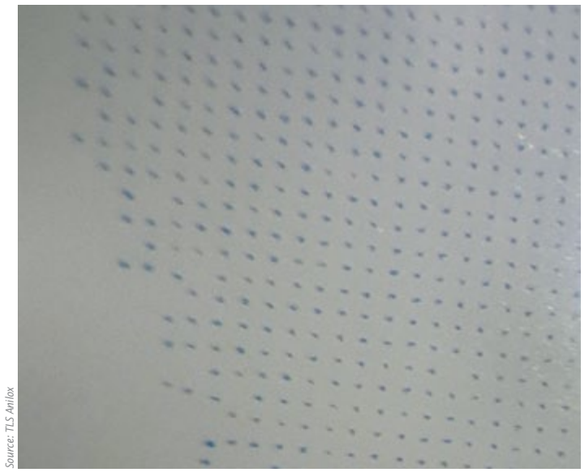
TeroLux in use - A field report

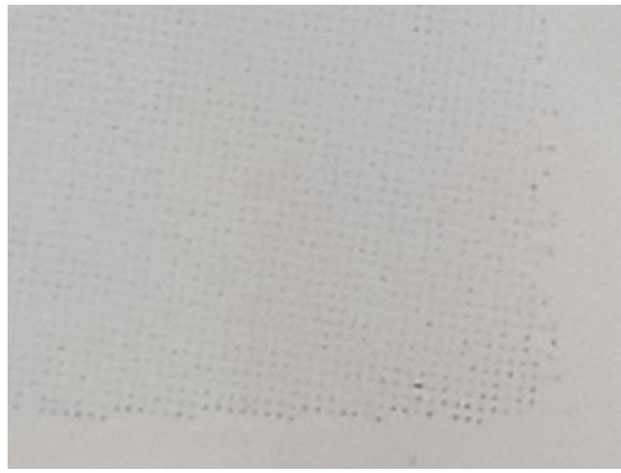
In 2018, TLS Aniox delivered its first TeroLux anilox roller to customer Amcor Moorabbin in Australia. Production Manager James Chrichton sums up the experience with this product as follows:

"We were looking for a solution to the problem of score lines which occurred on one of our Novoflex flexo presses from Windmöller & Hölscher. We informed the supplier accordingly and the suggestion was made to change the working angle of the doctor blade. However, this measure was not successful and testing different types of doctor blades also achieved no positive results.

We then did some market research for anilox rollers and contacted various suppliers, but without finding a proper solution to our scoring problems. TLS Anilox finally recommended the TeroLux coating and after the first such anilox roller arrived at our plant, we quickly realised the process advantages associated with it. We achieved higher as well as extremely uniform ink coverage along the entire web width. Therefore, we left this anilox roller in the press for several weeks to test its wear characteristics. However, we realised no indications of wear or scoring during the entire period, which is undoubtedly due to the extremely resistant hard metal coating made of tungsten carbide.

As a consequence of this positive experience, we started to switch all our anilox rollers to TeroLux and for the last 18 months TLS Anilox has been our sole supplier. Although the TeroLux anilox rollers transfer slightly more ink to the substrate than a competing roller with the same specification, we have been able to compensate for this by making appropriate adjustments to our anilox specifications. Currently we run five flexo presses of three different types from Windmöller & Hölscher, all of which now equipped with TeroLux anilox rollers. The problem of scoring lines has never occurred again with these anilox rollers."





Source: TLS Anilox

The hard tear edge at runs towards 0% at screen rulings of 60 l/cm and dot size of 0.4%

plate surfaces. The use of these anilox rollers thus offers productivity potentials not to be underestimated.

A tried and tested system

TeroLux anilox rollers have now been in successful practical use for five years. They now account for more than 20% of TLS Anilox's turnover, making them the fastest-growing segment in the company's product portfolio. Correspondingly, the geographic spread of the customer base is quite broad, ranging from Germany, Europe, the CIS states, Egypt, Pakistan and Japan to Australia. In this context, it should also be noted that TLS Anilox offers its customers the possibility of cost-neutral tests with subsequent purchase of the respective rollers.

www.tlsanilox.com ■