

LUVIR Technology

The smart direct imaging solution for all conventional LPI materials

LUVIR: Running production at Würth Electronics Germany

With headquarters in Niedernhall (Hohenlohe), Würth Elektronik GmbH & Co. KG (WE Group) is a leading supplier of electronic & electromechanical components, control systems, sensors and PCBs and represented at 16 production sites worldwide. In the financial year 2018, the WE Group generated sales of approx. EUR 850 million and employs around 8,500 people around the globe. In the Circuit Board Technology division, the Würth Group is active with approx. 1,000 employees at the sites in Niedernhall, Schopfheim and Rot am See.

Initial situation at the WE site Rot am See

At the Rot am See site, technically demanding prototypes and small series for leading customers from the automotive supplier sector (for example BOSCH), industrial electronics (for example Siemens) and medical technology are manufactured in 3-shift operation. With up to 100-120 different PCB designs per day, the on-site production process is flexible with high-quality "quick-turn" supplies, backed by an in-house developed e-commerce platform solution.

All in all, WE Rot am See has been using three DI systems in the photo department to produce photoresist and solder resist. For solder mask, the exposure of conventional inks is done on a high-end multi-wavelength DI system and a manual contact imaging system (mask / film) in 3-shift operation. The use of this combination increasingly led to production bottlenecks, as increasing customer demands and volumes were often only managed in manual multi-shift operation. In particular, the long exposure times of conventional inks for different layer thicknesses on the multi-wavelength DI system represented a critical bottleneck for the production (exposure throughput of about 4 panels per hour). Fully digital exposure of solder mask and the associated advantages in registration accuracy, throughput, and a sustainable reduction in process costs were therefore not possible based on the installed system base and exposure technologies used.

Essential requirement for a new DI system solution

- The conventional solder mask, certified by the end customer, should still be usable to avoid lengthy customer certifications and higher material costs as part of a switch to DI coatings.
- High-quality imaging of structures with coating thicknesses above 2mil with exposure times of max. 100 seconds per side (so far about 7 minutes per side.)
- Due to historical investments in three DI systems at the site, the initial cost of the system should not exceed EUR 0.5m. A long-term service contract for the system was not planned or desired.
- The footprint of the machine should not exceed 4m².

LIMATA system solution for Würth Elektronik: X1200 with LUVIR technology

Based on the technical WE specification and in compliance with the budget limits (Capex), Limata installed and calibrated a X1000 system solution with two LUVIR exposure units as X1200_SM configuration at the location in Rot am See. The cost of ownership of a Limata machine is due to reduced amount of UV-laser

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components much lower than compared to alternative LED/DMD systems, which needs - in lack of the IR laser – much more UV-LED power (heads) to be able to expose conventional inks.

In addition to the integrated LUVIR imaging technology, the X1000 system solution is characterized by compactness, flexibility and ease of use. The installation itself and embedding in the infrastructure, including the execution of the first exposures, was completed after 2 days. The acquisition and follow-up costs of the X1000 ("Costs of Ownership") are significantly lower than the costs of alternative LED / DMD exposure systems due to a reduced number of built-in UV laser components in the system, which would need significantly more UV LED power (Heads) to expose conventional inks with high energy requirements without LUVIR technology.



Figure 1: LIMATA X1000 system series

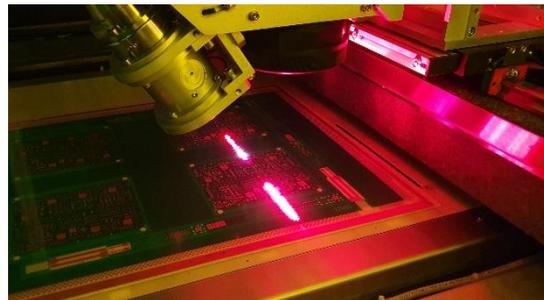


Figure 2: LUVIR exposure in production

As a result, the following key acceptance criteria for the LIMATA X1200 LUVIR system solution were successfully demonstrated during production at the Rot am See site:

(a) Imaging of structures at coating thicknesses in the range 2-3 mil without significant undercut

The dimensional accuracy is essential in the area of the solder resist since the panel is exposed to various aggressive chemicals during subsequent process steps. If this dimensional accuracy is not maintained, the stability / adhesion of the structures in the further process steps cannot be guaranteed.

(b) Complete edge coverage

Polymerization of the ink was complete - even beyond the copper edge - without unwanted side effects such as bleeding of the ink over the edge.

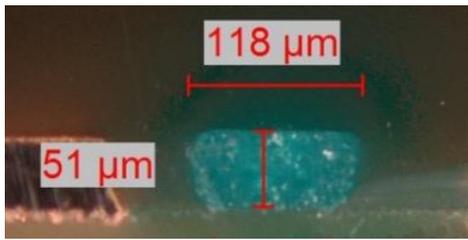


Figure 3: Cross section conv. ink system green (Peters)

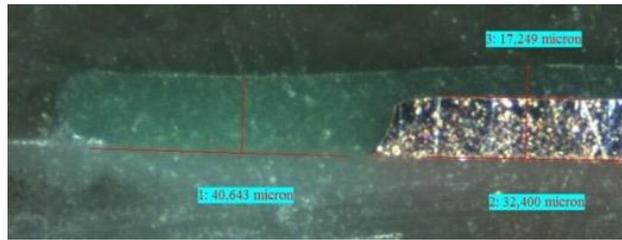


Figure 4: Edge cover conv. ink system green (Taiyp PSR 4000 BN)

Compared to LUVIR, other technologies show a considerably poorer edge geometry, or coating thicknesses above 2mil can no longer be processed.

(c) Ionic contamination („bleeding“)

The ionic contamination measurement is an extractive analysis method, which allows a quantitative recording of the ionic contamination on electronic assemblies. Ionic contamination is often the reason for field failures, therefore, this method is crucial for the risk assessment of the PCB.

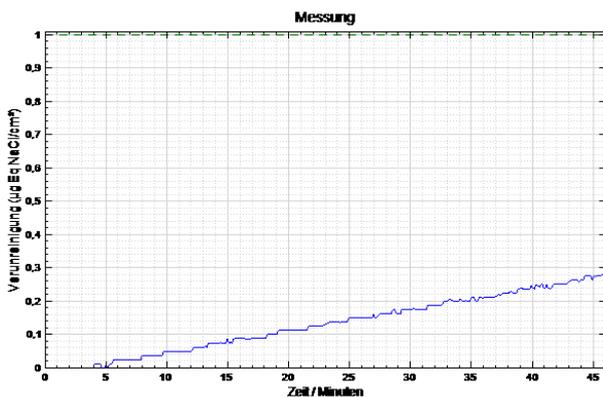


Figure 5: Contamination measurement conv. ink System Green LUVIR

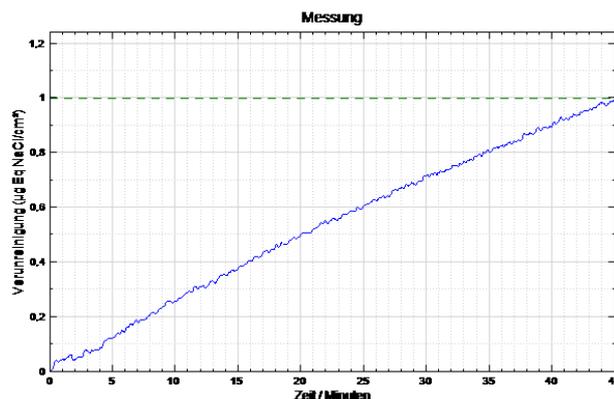


Figure 6: Contamination measurement conv. ink System Green Contact imaging system at 7kW

The measurement duration is 46 minutes, with a measurement surface of 562.23 cm². The direct comparison in the same process shows that the LUVIR technology achieves a far more efficient cross-linking than with conventional contact exposure / mask exposure. The ionic contamination of the LUVIR exposure after 46 minutes is 0.262 µg Eq. NaCl / cm², whereas 0.988 Eq. NaCl / cm² are measured with conventional contact exposure for an identical measurement duration.

(d) Fulfilling the throughput requirement and sustainable capacity

The throughput requirement in terms of alignment and exposure of <100 seconds (36-40 prints / h) in compliance with qualitative parameters could be proven successfully and stable with the X1200 LUVIR system solution in ongoing multi-shift operation ("Repeatability"). This corresponds to an increase in throughput of approx. 400% of conventional inks compared to the DI system solution with multi-wave technology previously installed in the solder mask department.

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Mr. R. Göhringer, Head of Production WE Rot am See emphasizes:

„Thanks to the LUVIR technology, the solder resist process could be switched directly from the previously used mask exposure to direct exposure. As an outstanding digital solution on the market, this technology has been able to demonstrate fast process times and superior quality on our certified conventional ink in production. This allowed us to fully digitize the solder mask process at low cost - without process or ink adjustments. An excellent benefit to our production in Rot am See.“



Figure 7: M. Nagel (General Manager Limata), H. Scheuerlein (Head of Photo Department WE), R. Göhringer (Production Manager WE) from left to right

In the course of the X1200 installation, the entire solder resist production was switched at WE Rot am See, from manual exposure and multi-wavelengths DI to LUVIR laser direct exposure.

Since then, the conventional solder resist has been processed using a Limata X1200-SM. As of today, more than 100,000 production panels have already been exposed with the X1200 system solution, thus successfully digitizing the solder resist process at WE in Rot am See“.

The resulting productivity and efficiency improvements at the site also ensure a complete "Return on Invest" of the cost-effective X1200 system of approx. 2 years.

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