

Copprint LF-350

March 2021

Nano Copper Paste for PET Substrates Application Notes



Overview

Copprint LF-350 is a solvent-based copper paste for additive printing of electronic patterns on PET substrates. Copprint LF-350 contains Nano Copper particles, and enables oxidation free, high conductivity copper printing in an air environment, with rapid self-sintering and curing at 200°C. Copprint LF-350 is the highest performance, most sustainable, lowest cost Copper paste suited for manual, semi-automatic or reel-to-reel screen printing applications.

The application notes provide instructions and guidelines for optimal screen printing with Copprint LF-350 including:

1. Storage
2. Screen Printing
3. Drying
4. Sintering
5. Relaxation
6. Clean Up, Maintenance

Printing guidelines and recommendations

1. Copprint LF-350 Storage

Copprint LF-350 should be stored below -10°C. Mix the paste in the original container before printing using a paste mixer (Figure 1) - Eg. ZB500S, solder paste mixer, 15min at 300rpm, or manually until homogeneous in composition throughout.



Figure 1
ZB500S, solder paste machine

2. Screen Printing

Copprint LF-350 is suited for screen printing on PET substrates.

Pour the requisite volume of paste needed for printing to a new container and verify that it reaches room temperature before printing.

Select your desired screen mesh. The mesh defines the printed pattern layer thickness and pattern resolution. We recommend printing using a screen mesh of 100-150, NBC-MESH (Japan) UX100/040- UX 150/40. Screen printing is based on print-flood procedure.

Recommended substrates:

Substrate	Substrate	Supplier
Polyester (PET)	Elecrom STS H.08 (opaque) Elecrom STS A.00 (transparent)	Polycrome https://www.elecrom.it/
	HSPL 80 HT (opaque)	Coveme https://www.coveme.com/
	CF-T1/PD (transparent)	Folex https://www.folex.com/
	Melinox STS505	DuPont Teijin Films http://www.dupontteijinfilm.com/
	AUTOSTAT AHU5/ HT5/CT5* *CT5 has higher shrinkage at working point	MacDermid Autotype https://industrial.macdermidenthone.com/

Other types of PET may be compatible with LF300 and processing conditions, we suggest comparing performance on any new substrate with performance on a recommended substrate.

Do not return any unused paste to the original container. Close and seal the original container and return to storage at -10°C.

3. Drying

After printing, dry the pattern immediately. Drying in a conveyor belt oven with hot air is recommended. For lab scale testing we use a Reflow oven T-961 from Puhui (www.puhuit.com)



Figure 2
Reflow Oven

The reflow oven is set to enable the following temperature profile (90C in this module):

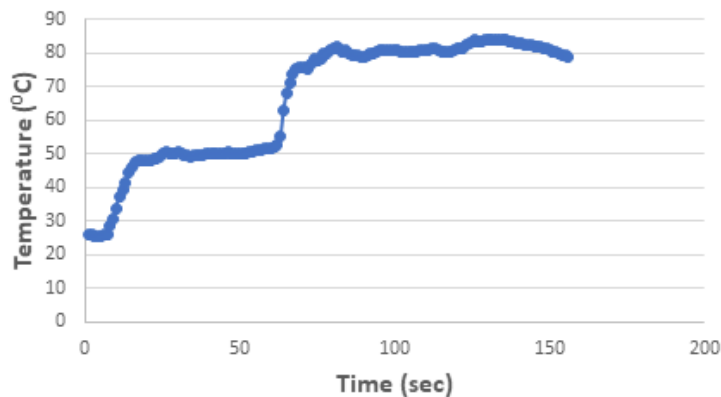


Figure 3. Temperature profile of the single cycle run (reflow oven)

Other manufacturers and drying equipment models may be suitable. Actual settings must be found for each type of equipment, over-drying will harm obtained electrical performance.

4. Sintering

The dried printed pattern should be sintered within 72 hours after drying. The sintering process is based on thermal heating in air environment. No inert atmosphere (like nitrogen) is required.

The sintering takes place under 'snap heating' (Achieving the desired temperature quickly in a few seconds).

In order to obtain that snap heating process, we suggest using a Heat press. There are different heat press machine options that can be used, including ones with dual (figure 4) or single (figure 5) hot plate, pneumatic (figure 4) or manual (Figure 5). The larger pneumatic hot press gives much better results than the small manual machine.



Figure 4
Heat press machine



Figure 5
Manual 200\$ Heat press machine

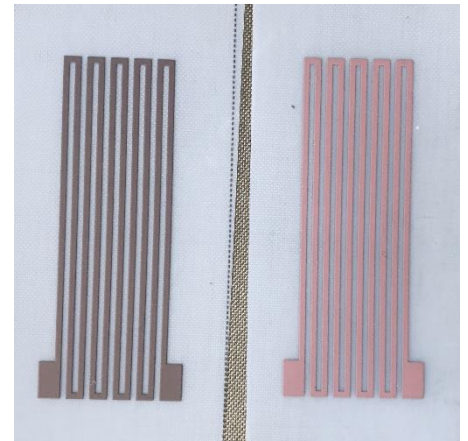


Figure 6
Non sintered (left) and sintered (right)
printed pattern on PET

Optimal sintering conditions are: 60 sec@ 200°C (measured temperature). High pressure is not required, the purpose is to have a close contact of the heating plates and the sintered pattern. We recommend placing the printed pattern in the heat press when it is placed between two sheets of baking paper to prevent scratching and keeping the press clean. A well sintered sample will have a lighter copperish color, as can be seen in Figure 6.

Manual hot press

Can be found on Amazon/ AliExpress, these are intended for use with t-shirts (Digital Sublimation Heat Press Machine for T Shirt), see examples from Amazon [here](#) (110V), or [here](#) (220V), and an example from AliExpress [here](#).

A temperature calibration is needed based on the actual measured temperature as you need 200C for sintering, (i.e. to get an actual 200C you may need to set the hot-press to 180 or 220c...)

We recommend sintering with this type of hot-press as following:

1. Set the temperature on the hot-press.
2. Check the temperature by placing a thermocouple in the closed mode, after closed for at least 1 minute.
3. Adjust temperature set-point if needed.

Actual sintering:

4. Close the hot-press (empty) for 60 seconds to heat up the bottom tray of the hot-press
5. Open, place the samples (enclosed in baking paper to protect form scratches) inside the hot-press and close for the needed sintering time

A movie showing these steps: <https://youtu.be/yXCMHUBEVAg?t=164>

A **large hot-press** can be purchased directly from one of two manufacturers:

COLOR KING (this is the one shown in the movie)

<http://www.color-king.net/product.php?id=995>

Contact: Joseph@color-king.net

AUPLEX

http://www.auplexheatpress.com/a/products/Press/Dual_Heat_Press/2018/0516/41.html

contact: sarah@auplexheatpress.com

Caution: Always wear oven gloves when handling the heat press

A short movie that demmonstrates all these steps is available online:

<https://youtu.be/fuV61MQ82xw>

NOTE: This video shows a single sheet sintering. Multi-sheet sintering (paralell 20 pages) can be performed as well. Please contact us for more details.

5. Relaxation.

In order to get the best results in terms of adhesion and flexibility, sintered samples must go through a relaxation stage, by heating to a temperature of 140C for 2-3 minutes (110C for PC substrate). We recommend using the same conveyor oven as used for the drying.

6. Clean Up & Maintenance

After printing screens should be cleaned (within up to 2 hrs.) to avoid copper contamination on the mesh.

Screen cleaning instructions:

1. Wipe off any remaining Copper paste with a paper towel.
2. Wet both sides of the screen with Dowanol DB solvent.
3. Gently wipe the screen in a circular motion with a sponge / soft fabric soaked with Dowanol DB. Wipe till remainder of paste is softened (the liquid will turn dark).
4. Wash the screen with tap water. Wet screen areas that have remaining paste with Dowanol DB solvent.
5. Repeat steps 2-4 till the screen is totally clean.

6. Dry the clean screen with paper or dry fabric and leave it to dry.

Disclaimer

Copprint is not responsible for misuse of its products or their use in conjunction with unsafe or improperly maintained equipment or for uses other than intended as specified in this application note.

Product MSDS, Product TDS can be found at Copprint resources.

www.copprint.com