

**Product Description**

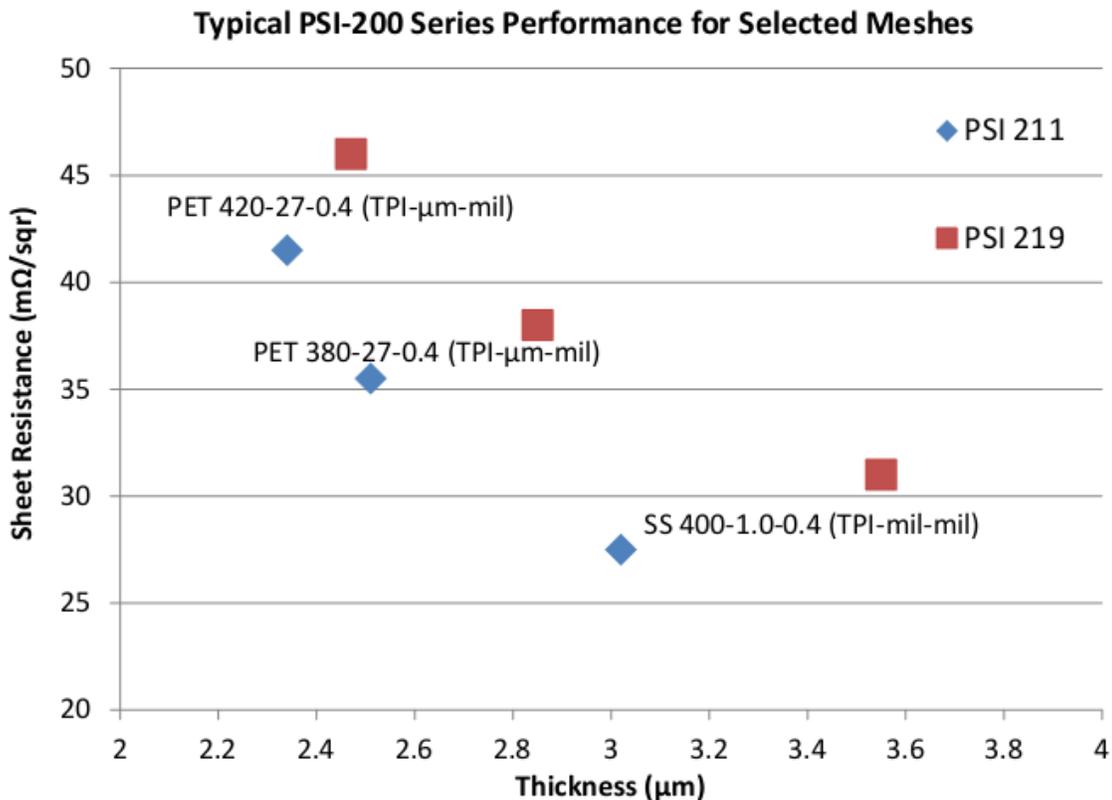
PChem’s PSI series of nano-silver screen inks have been specifically formulated for high conductivity and minimal cured film thicknesses. This allows equivalent sheet resistances with less material usage compared to competitive inks.

**Key Benefits**

- Fast curing at low temperatures suitable for reel to reel processing on PET film
- Excellent conductivity and thin cured film thicknesses for material cost savings
- Good printability, with features less than 4 mil (100 microns) possible
- Good flexibility and crease resistance
- Good adhesion to print treated polyester films
- Minimal VOC’s
- Easy cleanup with soap and water

**Application Guidelines**

Mesh selection should be based on sheet resistance and resolution goals. The chart below gives typical performance results for a range of screen meshes.



Contact PChem if help is needed in screen mesh selection.



**Emulsions** for use with water based inks are required, such as:

Sefar: Premier Dual Cure Emulsion type MH

Kiwo: KIWOCOL 300 WR, KIWOCOL POLY-PLUS HWR, POLYCOL DISCHARGE, POLYCOL LIGHT-SCRIBE, Poly-Plus SRX

Other emulsions intended for water based inks may also be sufficient.

In general when processing emulsions for use with water based inks it is recommended they should be as dry as possible during exposure, and the exposure time should be as long as possible without sacrificing image quality. For most applications, an emulsion over mesh (EOM) thickness of 0.4 mils is adequate. For more challenging applications, a very low roughness EOM may be preferred.

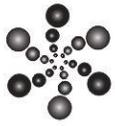
The ink should be mixed well before use. Humidity in the press room should be maintained as high as readily possible during use to minimize the drying rate of the ink (>50% RH recommended). During production use it is recommended to run press speeds with significantly higher impressions per hour than typical with slow drying solvent based silver flake inks. Maximum press speed possible will depend on the oven length, heating method, and temperature settings, but greater than 700 impressions per hour are feasible.

During printing, press stoppages, and prior to cleaning up **FLOOD COATING IS ESSENTIAL!** The ink should not be allowed to sit and dry on the screen in a post-print non-flooded state, because the residual ink in the mesh can dry quickly becoming difficult to fully clean from the mesh. Unapproved thinners, such as tap water or organic solvents **MUST NOT** be added to the ink for thinning. If these guidelines are strictly followed, then cleanup should be easy using only soapy water (see Cleanup section).

## **Curing Guidelines**

The PSI series inks can be cured with IR, convection, or conduction heating. The fastest results will be achieved with IR and conduction heating. Heating with 100w/in<sup>2</sup> short to NIR lamps will cure the ink fully in under 5 seconds. Back side conduction heating at 140°C will cure the sample in under 15 seconds. Pure convection heating of suspended samples at 140°C will cure the sample between 15 and 90s, depending on the rate of air impingement. Lower cure temperatures will result in longer cure times. Depending on the specific PSI formulation being used, temperatures as low as 80-100°C can be used with cure times under 5 minutes.

Please contact PChem for more details on ink selection, emulsion and mesh selection, cure kinetics, advice on oven design for new installations, or any other questions you may have.



## Recommended Substrates

PSI series inks can be printed well on most substrates, but to achieve maximum adhesion, print treated or primed substrates are highly recommended. Please contact PChem for help with substrate and ink selection relative to your product goals.

## Cleanup

Use a solution of approximately 1:10 by volume of general purpose dish detergent (Palmolive, Dawn, etc.) to deionized or distilled water. Deionized or distilled water **MUST** be used for thinning and making up the cleaning soap solution. Do **NOT** use solvents (ethyl acetate, alcohol, etc...) or alkaline pH aqueous ink cleaners on a screen mesh coated in PChem PSI series silver ink.



**Step 1:** Keep the screen flooded with ink until ready to clean. Scrape or squeegee off the bulk of the ink from screen thereby leaving the open mesh areas filled with wet ink. **Immediately proceed to Step 2!**



**Step 2:** Wet the top and bottom surface of screen mesh with soapy water solution.



**Step 3:** Using a soft soapy sponge or rag, gently wipe off remaining silver ink. Repeat until the mesh is clean.



**Step 4:** Rinse with water, dry frame with towel, air dry mesh before reuse.

## Storage and Handling

The ink container should be sealed when not in use. The ink should be stored in a cool environment. During storage, the pH of the ink should be monitored monthly to ensure it does not drop below 5.65. If the pH drops below this value, it can be adjusted back upwards with a dilute ammonia solution. See the pH and Solids Adjustment section below for more information. Refrigeration will extend the time the ink can last without pH adjustment, but freezing is not recommended. Typical storage times without adjustment can be on the order of several months, depending on ambient temperature and how well the container is sealed. Ink that is used frequently, or has spent a long time on the screen will need to have its pH checked more frequently. With proper maintenance of the ink's pH, a shelf life greater than 6 months is possible.



If no pH meter is available, then the pH of the ink can be estimated by its rheology. As the pH drops the ink will get a gel like structure such that when mixed with a spatula or ink knife a somewhat rigid cut is left behind which only slowly fills back in with ink. When the pH is in the proper range the ink should flow smoothly back around the spatula as it passes through it. If pH is raised too high, the ink may seep through more open meshes.

## **pH and Solids Adjustment**

The pH of PSI series inks drop gradually during storage, and more rapidly during printing. The pH of the ink will need to be raised by adding dilute ammonium hydroxide. When to adjust can be determined by either direct pH measurements or by noting the ink's rheology as described above. Mixing of the ink or swirling of the probe within the ink should always be used during pH measurement and adjustment. Clean the pH probe with soapy water and a toothbrush then rinse with distilled or deionized water.

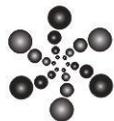
PChem recommends using a **0.5% (per NH<sub>3</sub>) solution of ammonium hydroxide in DEIONIZED or DISTILLED WATER**. Adding too much of a higher concentration base solution can potentially shock/destabilize the system and is not recommended. **Warning:** over adjustment of the ink pH past the upper specified value of pH 5.90 can result in excessive thinning and possibly irreversible damage to the ink. The ammonia solution should be mixed into the ink in a well ventilated area. If no pH meter is available, then we recommend adding the ammonia drop wise until ink reaches desired consistency. NEVER use tap water with PSI series inks!

If you have questions on how to properly measure or maintain ink pH, please contact PChem for more detailed instructions.

When using PSI inks in low humidity conditions or with low rates of ink consumption the solids content of the ink can increase due to water evaporation. The dilute ammonia solution used to adjust pH also lowers the solids content, but it is possible that water loss is still greater than ammonia loss. If it is suspected that the solids content of the ink is increasing even though the pH is acceptable, a weight assay can be done with an oven and a precision balance. If it is determined that the solids content of the ink has increased to an unacceptable level but the pH is acceptable than a lower concentration ammonia solution should be used. Do not try to dilute the ink with alcohol or any organic solvents. Please contact PChem for solid assay methods.

## **Material Recycling**

PChem Associates recycles all ink, printed product, wash-up solution, wipes, rags, and all waste materials containing silver. We encourage our customers and partners to do the same. Up to 90% of the current market value of the reclaimed silver can be



returned to the user through recycling. Please contact PChem Associates for more information.

## **Health and Safety**

Good health and hygiene practices should be followed. Safety glasses, chemical resistant gloves, and a lab coat should be worn at all times. Proper ventilation should be used at all times when working with this material. Upon heating/curing, the oven should be exhausted outside the building. See the PChem MSDS for more information.

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