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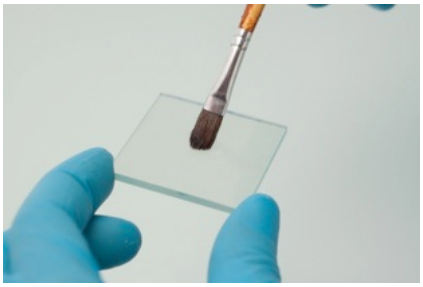
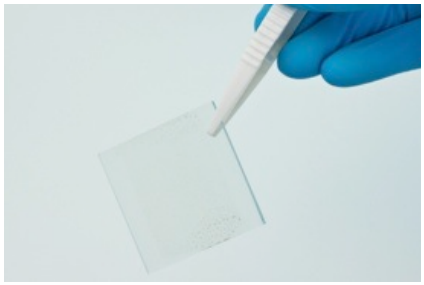
Platisol T

Platinum Catalyst Precursor Paint

Platisol T is a liquid paint containing a platinum precursor which forms a quasi-invisible catalytic layer of platinum by heat treatment.

Platinum coated electrodes for Dye Solar Cells can be prepared with Platisol T quickly and easily, without requiring sophisticated equipment.





Characteristics

Intended For	brush painting, spin-coating, or spraying
HS Code	7110.1900

Caution

Platisol T is a photo-sensitive product.
Avoid prolonged exposure to strong light sources. Store in dark.

Retail Quantities

5 mL	ref.	41150
10 mL	ref.	41111
20 mL	ref.	41121
50 mL	ref.	41151
100 mL	ref.	41112
200 mL	ref.	41122
500 mL	ref.	41152
1 L	ref.	41113

Pricing on product page:
solx.ch/platisolt

How to Order

Please visit our webshop at shop.solaronix.com, or send us an e-mail or fax indicating your desired products.

Bulk Supply

In addition to the retail quantities listed above, Platisol T is also available in bulk for industrial purpose. Inquiries are welcome.

USAGE

Most Dye Solar Cells (DSCs) use cathodes coated with platinum. The presence of a catalytic amount of platinum at the cathode enhances greatly the electron transfer rate to the electrolyte. This is in turn increasing the charge density in the solar cell, which directly translates into higher photo-currents.

Platisol T is a liquid paint containing a precursor of platinum which is transformed into an activated platinum coating by heat treatment at 450°C. This product can be easily applied onto electrode substrates with a paintbrush, which is an excellent method for quickly preparing test cells by hand. The formulation of Platisol T makes it adaptable for spraying or spin-coating.

After firing, the paint leaves place to a minimized amount of platinum for optimum material usage, while remaining ideally transparent and catalytically active.

Platinum Deposition With Platisol T

Make sure to clean your substrates appropriately before applying Platisol T. The presence of dirt on the surface can prevent a proper platinum deposition.

Dip a small paintbrush into Platisol T and let any excess of the product to drip off. If you are working with a transparent substrate, make sure to identify the conductive side to be treated.

Paint the entire surface of the conductive substrate. Platisol T is colorless, so use the reflection of the wet layer to determine whether the surface is completely covered.

A single pass is enough to obtain a catalytic layer of platinum. It is possible to apply several passes to increase the quantity of platinum, but this may lead to a darker layer after firing.

Without waiting, place the wet substrates on a programmable hot plate and heat up to 450°C with a gentle thermal ramp. Maintain 450°C for at least 10 minutes before allowing the samples to cool down to room temperature. Beware that an abrupt rise or drop in temperature can easily shatter glass substates.

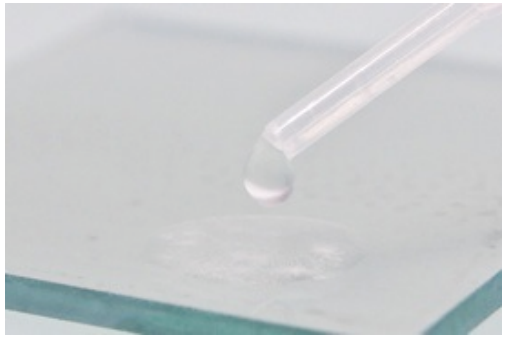
Don't expose excessively wet samples to light. This could degrade the platinum precursor in the paint before it forms the platinum layer.

The resulting electrodes will now bear a quasi-invisible layer of activated platinum. The amount of material is enough for an excellent catalysis of electron transfer in Dye Solar Cells without using an excess of platinum.

It is possible to observe gray stains on the resulting layer when Platisol T was applied unevenly, but this is purely aesthetic and will not affect cell performance.

Consider using the Platisol T/SP paste instead if the evenness of your platinum layer is very important.

The catalytic activity of the platinum layer can be easily tested with hydrogen peroxide once your samples have reached room temperature. Place a drop of a solution of hydrogen peroxide (aqueous, 35%) anywhere on the treated surface, but preferably outside the active areas of the solar cell. The evolution of tiny bubbles of oxygen should be visible immediately within the liquid, indicating the presence of an activated layer of platinum.



Evolution of O_2 in aqueous H_2O_2 showing the presence of activated platinum

Clean with deionized water and ethanol to remove any trace of hydrogen peroxide prior use of the platinum electrode.

Make sure to assemble the solar cells rapidly. Such platinum coated electrodes can slowly lose their activity over time when exposed to ambient air. Keep them in a sealed environment until you are ready for assembly.

Platinum coated electrodes prepared long ago before assembly can be reactivated with a new firing treatment as described above. When in doubt, test with H_2O_2.

Common Pitfalls

Prolonged exposure to bright light of the wet samples or stock Platisol T may degrade the product. Incomplete coverage of the electrode may result in no, or very little, bubbling with the H_2O_2 test. Both of these cases will result in lower cell performance than expected, but can be easily repaired by applying a fresh coating of Platisol T.

Storing prepared platinum electrodes for too long will cause the platinum layer to be deactivated over time. In a cell the catalysis will be too weak resulting in low performance. In this case it is possible to reactivate these electrodes with a subsequent firing process as described above.

EXAMPLE

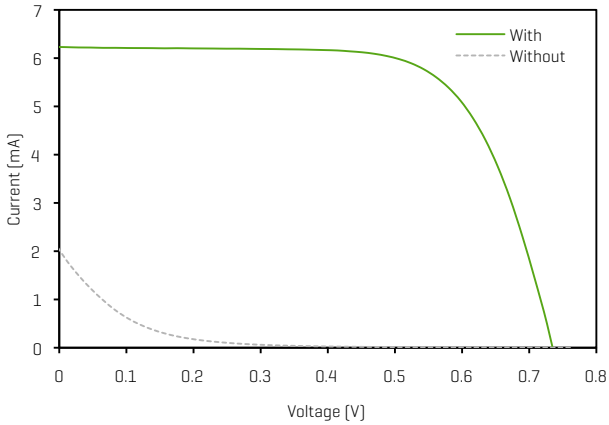
Effect of Platisol T treatment in Dye Solar Cells

Two sets of Dye Solar Cells were fabricated, without and with Platisol T treatment of the cathodes. For all these cells, a 36 mm^2 titania photo-anode was prepared with 4 printed layers of Ti-Nanoxide T/SP and 1 printed layer of Ti-Nanoxide R/SP on a TCO22-7 glass substrate, and sensitized with Ruthenizer 535-bisTBA in the presence of Chenodeoxycholic Acid.

All cathodes were made of TCO22-7, the first set were used without platinum coating, while the second set were treated with Platisol T using the procedure described in this document.

The two electrodes were laminated together using Meltonix 1170-60, and the solar cell was filled with Iodolyte HI-30 through a hole in the cathode. The filling hole was then sealed with Meltonix 1170-60 and a thin glass circle of 6 mm diameter.

The resulting solar cells were placed under 1 sun illumination using a Solaronix Solixon Class-A solar simulator, and equipped with an adequate mask to avoid overestimated results.



	Without		With
V_{oc}	726 mV	V_{oc}	735 mV
J_{sc}	5.6 mA/cm^2	J_{sc}	17.30 mA/cm^2
FF	0.04	FF	0.69
Eff.	0.2 %	Eff.	8.7 %

STORAGE AND SAFETY

Storage

Caution, Platisol T is a photo-sensitive product. Store the product in the dark in its original opaque container, upright and tightly sealed. Keep in a dry place at room temperature.

The product is not known to suffer from degradation when stored properly. Consider filling the container with inert gas for long term storage.

While in use, avoid to keep the container open unnecessarily, and avoid prolonged exposure to light.

Safety

Platisol T is for research and development use only, and is intended to be manipulated by knowledgeable personnel. Ensure good ventilation of the workplace, and wear suitable protective equipment.

Signal word: Danger

For a complete description of safety measures, please refer to the Material Safety Datasheet (MSDS) of Platisol T.

solaronix.com/msds/

RELATED PRODUCTS

Cited in This Document

- Ruthenizer 535-bisTBA, industry standard photo-sensitizer.
- Chenodeoxycholic Acid, staining additive.
- TCO22–7, 7 ohm/sq. FTO coated glass substrates.
- Ti–Nanoxide T/SP, screen-printable titania nanoparticle paste.
- Ti–Nanoxide R/SP, screen-printable reflective titania paste.
- Iodolyte HI–30, very high performance electrolyte.
- Meltonix 1170-60, hot-melt sealing films.
- Solixon, continuous illumination solar simulators.

Consider Also

- Platisol T/SP, screen-printing platinum precursor paste.
- TCO22-15, 15 ohm/sq. FTO coated glass substrates.
- TCO30-8, 8 ohm/sq. FTO coated glass substrates.

REFERENCES

People Using Platisol T

A selection of publications using Platisol T:

- Journal of Power Source, 2013, 239, 122-127 [doi:10.1016/j.powsour.2013.03.079]
- Solar Energy Materials & Solar Cells 2013, 117, 9-14 [doi:10.1016/j.solmat.2013.05.012]

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