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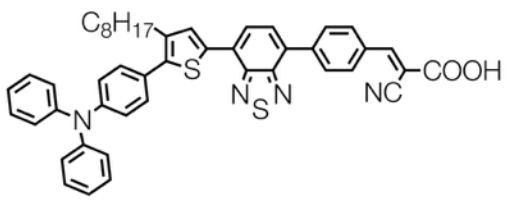
Sensidizer RK1

High Performance Organic Photo-Sensitizer



For industry or researchers who manufacture or study Dye Solar Cells, Sensidizer RK1 is a high performance organic dye which very efficiently sensitizes wide band-gap semi-conductors like titanium dioxide.

Unlike lower quality supplies, Sensidizer RK1 is ready to use and doesn't require extra purification. Our product is high quality and tested in real solar cells.

Characteristics

Aspect	red brown powder
Synonyms	RK1
Chemical Name	2-cyano-3-[4-[7-[5-[4- [diphenylamino]phenyl]-4-octylthiophen-2-yl]benzo[c][1,2,5] thiadiazol-4-yl]phenyl] acrylic acid
Molecular Formula	$C_{46}H_{40}O_2N_4S_2$
Formula Weight	744.97 g/mol
HS Code	7110.49
Absorption λ(max)	366 nm (4.5); 470 nm (2.66); (ε/10^4 M^{-1} cm^{-1})
HOMO Level	-5.05 eV
LUMO Level	-3.35 eV
Solubility	MeOH, EtOH, $CHCl_3$, iPrOH

Retail Quantities

5 mg	ref.	22750
10 mg	ref.	22711
20 mg	ref.	22721
50 mg	ref.	22751
100 mg	ref.	22712

Pricing on product page:
solx.ch/sensrk1

How to Order

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

USAGE

Solaronix introduces Sensidizer, a collection of new commercially available metal-free organic dyes for applications in Dye Solar Cells. These dyes offer customers the possibility to fabricate DSSCs without ruthenium-based sensitizers.

Sensidizer RK1 can be used as a semiconductor sensitizer, such as titanium dioxide or zinc oxide. This dye features a good solubility and an intense absorption spectrum that lead to highly colorful electrodes.

Staining Procedure For Titania Electrodes

Weight the amount of dry powder necessary to make a 0.2 mM methanol solution of the required volume. Make sure the volume is sufficient to completely immerse the electrode(s).

> *The addition of chenodeoxycholic acid (10 fold) in the staining solution yields a significant performance boost.*

Place the dye powder in a sealable container and add the required volume of ethanol. Absolute ethanol is good, but not strictly necessary. Alternatively, methanol can be equally employed with this dye.

Stir the mixture in a sealed vessel at room temperature (e.g. a glass bottle with stir bar). The solution turns orange although most of the solid is yet to be dissolved. Coarse grains can take awhile to dissolve, so prolong stirring until no traces of solid are visible, or use sonication to help dissolution .

> *Flocculation of the dye could appear for high concentrations*

Position the titania electrodes in a flat-bottomed, sealable container, side by side, with titania layers facing up. This is important in order to prevent scratching the fragile titania surface.

Pour a freshly prepared dye solution into the container and fully immerse the electrodes. Too little liquid won't allow the titania surface to adsorb enough dye and the electrodes may appear unevenly colored.

> *For best results fire the titania electrodes just before staining so that they don't pick up ambient moisture. It is best to put them in the staining bath while still warm, 50-60°C. Such mesoporous titania electrodes are easily polluted by volatile substances.*

Seal the container with a lid and wait for the titania surface to get entirely stained. This takes several hours and can be conveniently left overnight. Make sure to avoid excessive light exposure during the staining process. Dye molecules are very light sensitive in solution, and even more so when adsorbed on titania and dry.

Remove the stained electrodes with plastic tweezers (to avoid metal traces pollution). Rinse thoroughly with ethanol to remove any excess dye which could otherwise cause a detrimental build up of dye molecule. Discard the rinsing waste.

> *Staining solutions can be reused several times, provided the concentration is sufficient. However, dye solutions are not suitable for long term storage. Dye oxidation and precipitation may occur over time. It is preferable to store the dried dye powder in its original container and prepare solutions when needed.*

Completely dry the electrodes with an inert gas flow or with a brief blow of a hair-drier from a reasonable distance. Make sure to assemble the solar cells immediately. Stained electrodes are fragile, keep them in a sealed environment away from light until you are ready for assembly.

A properly stained titania electrode should look quite dark (especially if opaque) and red (in any case), otherwise it will result in poor cell performance.

Common Pitfalls

A white or faded coloration indicates poor staining, the entire surface of the electrode visibly didn't get colored. Try to increase the dye concentration or lengthen the staining time. If the problem persists, use recommend staining conditions for troubleshooting, change solvent, or check for moisture in the solution.

It could also indicate the structure of the titania electrode is not porous enough. Investigate possible titania issues such as firing process, poor porosity, or large particle size.

Avoid exposing freshly stained electrodes to ambient atmosphere or moisture of too long, dye molecules adsorbed on the titania can be easily oxidized, especially when exposed to light.

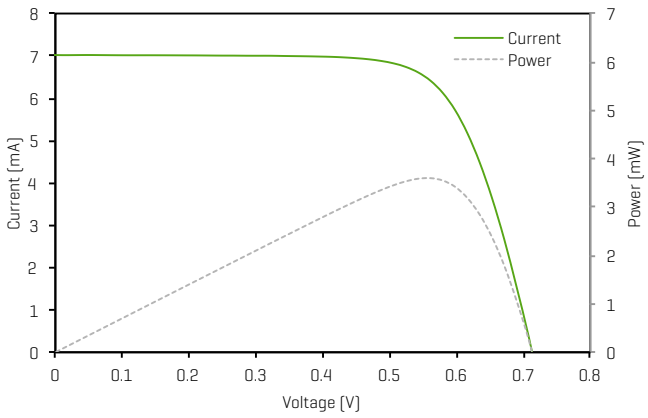
Staining the electrodes for too long will severely reduce solar cell performance due to dye molecule buildup. Consider using a lower concentration, or shorten the staining time if possible.

EXAMPLE

A Dye Solar Cell Sensitized with Sensidizer RK1

A 36 mm^2 titania photo-anode was prepared with 1 print of Ti–Nanoxide T/SP, 2 prints of Ti-Nanoxide MC/SP and 1 print of Ti–Nanoxide R/SP on a piece of TCO22–7 glass substrate. The electrode was treated with $TiCl_4$, and stained in a solution of Sensidizer RK1 using the procedure described above with chenodeoxycholic acid (1:10) as a co-adsorbent. A platinum coated cathode was prepared on another TCO22-7 substrate with a layer of Platisol T. 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 cell was placed under 1 sun illumination using a Solaronix Solixon Class-A solar simulator and equipped with an adequate mask to avoid over-illumination, yielding the following current-voltage curve and tabulated results.



V_{oc}	713 mV
J_{sc}	19.50 mA/cm^2
FF	0.72
Eff.	10 %

STORAGE AND SAFETY

Storage

Store the product in its original container, upright and tightly sealed. Keep in a dry place at room temperature, away from light exposure.

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

While in use, avoid leaving the container open unnecessarily.

Safety

Sensidizer RK1 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 Sensidizer RK1.

solaronix.com/msds/

RELATED PRODUCTS

Cited in This Document

- Chenodeoxycholic Acid, staining additive.
- TCO22–7, FTO coated glass substrates.
- Ti–Nanoxide T/SP, screen-printable titania nanoparticle paste.
- Ti–Nanoxide MC/SP, screen-printable titania nanoparticle paste.
- Ti–Nanoxide R/SP, screen-printable reflective titania paste.
- Platisol T/SP, screen-printable platinum precursor paste.
- Iodolyte HI–30, very high performance electrolyte.
- Meltonix 1170-60, hot-melt sealing films.
- Solixon, continuous illumination solar simulators.

Consider Also

- Ruthenizer 535, protonated analogue to Ruthenizer 535–bisTBA
- Sensidizer SQ2, a green-colored purely organic dye by Solaronix
- Labware: Staining Boxes, Plastic Tweezers

REFERENCES

For further reading, have a look at the following article:

- Scientific Report 4, 2014, Article Number : 4033
  [doi: 10.1038/srep04033]
- Energy Environ. Sci., 2015 [doi: 10.1039/C5EE00444F]

Find Out More

Visit the Sensidizer RK1 product page for more information:
solx.ch/sensrk1

How to Order

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