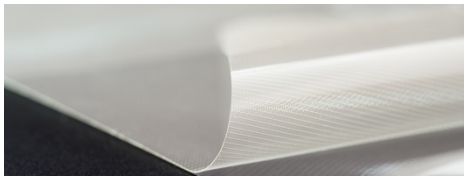
Transparent Electrodes



Highly conductive transparent fabric based electrodes

Product Features

Sefar's fabric based electrodes meet the demands from various markets for conductive materials having high transparency or permeability at the same time. This patented technology includes the following product lines:

- Transparent Conductive Fabrics (TCF)
- Transparent Conductive Substrates (TCS)

Sefar's transparent electrodes have several advantages:

- Incomparable high in conductivity
- Highly transparent
- Excellent flexibility (no loss of conductivity when bended)
- Roll to roll process ability
- Large optoelectronic devices possible (enabler)
- Various metals or metallic yarns on request
- Additional functions can be added to the wire or fabric

All our materials are produced in a roll-to-roll process and can be delivered in rolls or sheets. Our know-how, machines and patents allow us to offer you a customized solution meeting the requirements of your specific application.

SEFAR Transparent Conductive Fabrics (TCF)

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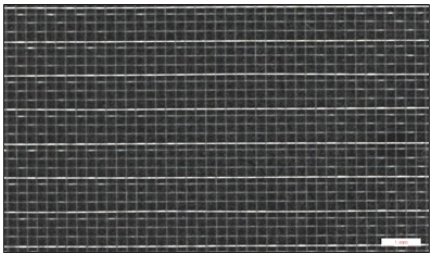
The SEFAR TCF range is defined by an optically transparent monofilament polymer fabric, containing fine metallic wires or metallization.
Typical wires which are being used are stainless steel, copper, coated copper, nickel aluminum with diameters in the range of 0.020 – 0.300 mm.
Depending on wire diameter and wire pitch (distance between two wires) transparencies up to 94% can be reached. The conductivity depends strongly on the material, wire diameter and wire pitch. The family of SEFAR TCF contains large number of products, which can be adapted specifically on customer's specification.



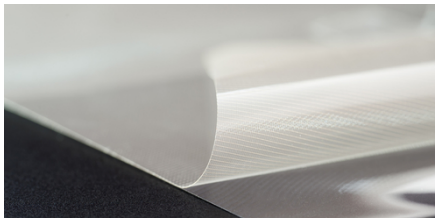
Example of a SEFAR TCF, containing metallic wires, one-directional, 0.01 Ω/□, 94% light transmission.

Top lamination of various SEFAR TCF was successfully applied in miscellaneous solar cells, like silicon solar cells, dye sensitized solar cells, perovskite solar cells, and organic solar cells.
Our know-how, machines and patents allow us to offer our partners a customized solution for their specific application.

SEFAR Transparent Conductive Substrates (TCS)

Many optoelectronic devices require two electrodes, at least one of which must be transparent. There are different approaches to create a so-called transparent electrode. Thin metal or metal oxide layers, conductive polymers or silver nanowires are usually used. To a certain extent, these conductive materials function excellently. In order to make larger lamps (approximately > 10 x 10 cm), metallic guides are needed to improve the conductivity. Such electric paths can, for example, be printed or produced by etching.

The patented Sefar technology makes it possible to embedd highly conductive, thin wires into a kind of foil. At the same time they come to the surface of at least one side of this film, so the wires can be



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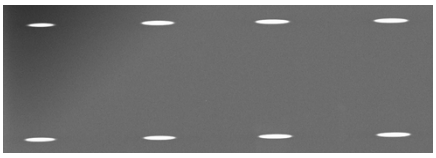
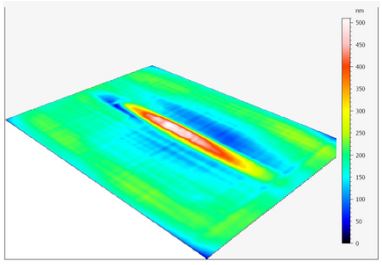
contacted. The nanometer-thin layers can now be applied unto this conductive side of the film.

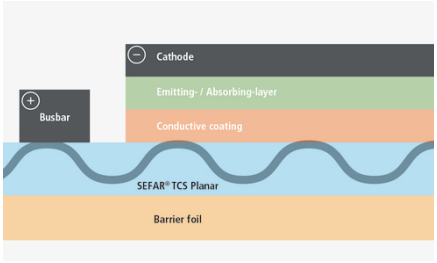
SEFAR TCS Planar, clean-room quality, conductive side is protected with a liner



SEM top view on SEFAR TCS Planar, exposed wire sections appear white while polymer filler appears dark grey



3D SEM topography of exposed wire section, wire is slightly protruded from the polymer filler and therefore making the surface conductive



Schematic example how to use SEFAR TCS Planar for optoelectronic devices

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