Clevios™ a Highly Conductive Polymer for Transparent Electrodes

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The Heraeus Group at a Snapshot

- We are a global precious metals and technology Group with firm roots in Germany. The company has been family-owned for more than 155 years.

- Precious metals, sensors, biomaterials and medical products, dental products, quartz glass, and specialty light sources are the focus of our activities.

- In 2011, we generated €4.8 billion in product revenue and €21 billion in precious metals trading revenue with about 13,300 employees in over 120 subsidiaries.
Thanks to Heraeus, the World has changed …

… use and communicate via the internet due to fiber glass cables all over the world.

… more than telephone thanks to modern microchips within our mobile phones.

… support environmentally friendly solar power production to make solar cells more efficient.

… entrust a platinum temperature sensor with our food.

… drink potable water purified by UV-sterilization lamps.

… produce fertilizers with the help of platinum gauzes.
isolators, conductive polymers, metals

**classic polymers**
$10^{-18} - 10^{-16}$ S/cm

**CLEVIOS™ (PEDOT:PSS)**
$10^{-4} - 10^{3}$ S/cm

**copper** $10^{6}$ S/cm

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Application prerequisite: Processability

- spincoating
- dip coating
- spraying
- doctor blading
- slot-die coating
- screenprinting
- CLEVIOS™
- gravure printing
- aerosol jetting
- flexo printing
- inkjet printing
Progress on Conductivity

Post-treatment of PEDOT:PSS-films improves conductivity by:

- removing excess PSS
- modifying film’s morphology

Further progress on Clevios conductivity is possible
CLEVIOS™ PH 1000 – Optical Properties

High transparency in visible!

$$R_{sh} = \frac{1}{\sigma \cdot d} \iff \frac{T}{T_0} = \exp(-\alpha \cdot d)$$
Example: Clevios™ F ET on PET film

High mechanical stress at edges and corners, (small-sized displays)

→ Risk of ITO Cracking
CLEVIOS™: combination of properties

- Conductivity: up to 1.000 S/cm
- Transmission: >85% in VIS
- Flexibility: >>50,000 bending cycles
CLEVIOS™ Etch: wet etching process

clean CLEVIOSTM

coat CLEVIOSTM

development

coat photoresist

UV expose

etch with CLEVIOSTM Etch

resist removal

non-conductive

conductive
Enabling transparent wire free LED-lighting

A Clevios FE-T coated curved PET-substrate has been structured into strips using Clevios Etch. The non-conductive and conductive areas have the same transparent appearance. The adjacent conductive segments are electrically bridged by LEDs. The result is clear illumination, with no apparent electrical connections.

Advantages:
- Invisible structure
- Flexible
- Long term stability

\[ U_{DC} = 36\text{V} \]
\[ I = 3\text{mA} \]
Thank you for listening

Come and visit our booth

# 742

Internet: WWW.CLEVIOS.COM