

## EddyCus® TF inline A – Inline Anisotropy Monitoring System

P\_T\_inlineA\_20



### Highlights

- ▶ Contact free and realtime
- ▶ Accurate measurement
- ▶ High degree of variability and flexibility
  - ▶ In- and ex-vacuo solutions
  - ▶ Fixed sensor and traverse solutions
  - ▶ Single-lane and multi-lane solutions
- ▶ High sample rate up to 1,000 measurements per second

### Applications

- ▶ Touch panel sensors(TPS)
- ▶ Printed electronics
- ▶ Wearable electronics
- ▶ Smart textiles
- ▶ Photovoltaics
- ▶ Smart / switchable films
- ▶ Medical surfaces and devices
- ▶ Biological sensors
- ▶ Aerospace, automotive, transport
- ▶ Semiconductor and memory
- ▶ Energy storage

### Sensor Series

- ▶ Metal thickness (nm,  $\mu\text{m}$ )
- ▶ Sheet resistance (Ohm/sq)
- ▶ Emissivity
- ▶ Conductivity / resistivity (mOhm·cm)
- ▶ Electrical anisotropy (%)
- ▶ Weight ( $\text{g}/\text{m}^2$ ) and drying status (%)
- ▶ Permeability (H/m) *Beta*

### Materials

- ▶ Nanowire films
  - ▶ Conductive NW (Ag, Ni, Pt, Au)
  - ▶ Semiconductor NW (Si, SiC)
  - ▶ Magnetic NW (Fe<sub>3</sub>O<sub>4</sub>-AgNWs)
  - ▶ Multilayer NW (ZnO/AgNW/ZnO)
- ▶ Carbon Nano Tubes and Buds
- ▶ Fiber reinforced composites
- ▶ Metal meshes, smart meshes
- ▶ Anisotropic grain / domain materials
- ▶ Anisotropic effect / defect directions (cracks, line defects)

SURAGUS GmbH  
Maria-Reiche-Strasse 1  
01109 Dresden  
Germany

For further questions:  
+49 351 32 111 520

[sales@suragus.com](mailto:sales@suragus.com)

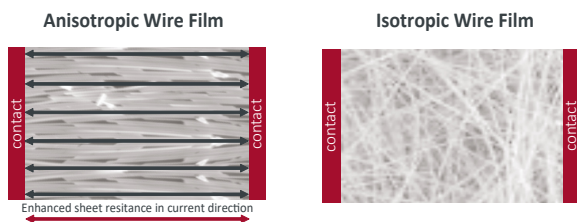
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Made and Engineered in Germany



## Anisotropy Term and Concept

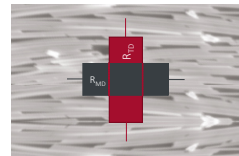
- ▶ Electrical anisotropy refers to a difference in electrical resistance depending on the direction of current flow
- ▶ Wire and mesh structures can have anisotropic resistances
- ▶ Bulk materials with dominant directional characteristics \ effects \ defects can also have electrical anisotropy
- ▶ Anisotropy can be optimized to the layout of the contacts
- ▶ Anisotropy can save material and improve optical transparency to sheet resistance ratio
- ▶ Described by anisotropy direction and strength
- ▶ Both characteristics must be obtained at the same position
- ▶ The anisotropy strength is calculated using the lowest and highest resistance that align in perpendicular directions
- ▶ Inline deposition, eg. slot die coating on moving web, tends to create lower resistances in machine direction “MD” and higher resistance in traversing direction “TD”
- ▶ Calculation as ratio of lowest and highest resistance



$$\text{Anisotropy Ratio} = \frac{R_{\text{HIGHEST}}}{R_{\text{LOWEST}}}$$



$$\text{Anisotropy Ratio} = \frac{R_{\text{TD}}}{R_{\text{MD}}}$$



## Device Characteristics

Sheet resistance measurement technology	Non-contact eddy current sensors with directed current induction
Substrates	Foils, glass, wafer, etc.
Measurement gap size	5 / 10 / 15 / 25 / 50 / 75 mm
Number of sensor pairs / monitoring lanes	1 – 99
Sensor sizes (W x L x H) in mm	Sensor M: 80 x 100 x 66    Sensor S: 34 x 48 x 117
Sheet resistance range	0.01 – 1,000 Ohm / sq; 1 to 5 % accuracy
Anisotropy range	0.33 – 3 (larger on request)
Environment	Ex-vacuo/ in-vacuo @ T < 60°C / 140°F (higher on request)
Sample rate	1 / 10 / 50 / 100 / 1,000 measurements per second
Hardware trigger	5 / 12 / 24 V
Interfaces	UDP, .Net libraries, TCP, Modbus, analog/digital
Available features	Metal thickness, optical transparency & reflection (OEM)

## Device Control and Software

- ▶ Several views and user level
- ▶ Live view with upper and lower limits and alarm functions
- ▶ Analysis view providing statistics
- ▶ Can handle data of several thousands measurements per second
- ▶ Data storage into SQL database
- ▶ Customizable automatic data export (csv, txt, xls,...)
- ▶ Several smart functions (automated DB cleaning, self-reference etc.)
- ▶ Parameterizable I/O modules (triggering of actions or alarms)

