

## EddyCus® TF lab 4040A – Anisotropy Tester

P\_T\_4040A\_20



### Highlights

- ▶ Contact free & realtime
- ▶ Accurate single-point measurement of isotropic and anisotropic films
- ▶ Manual software-guided mapping

### 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

### Device Series

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

### 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)

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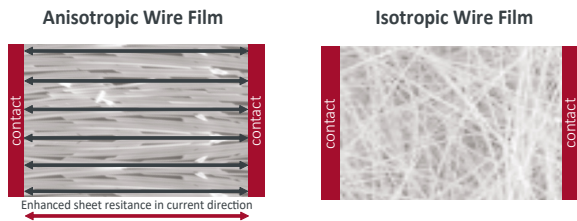
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## Anisotropy Term and Concept

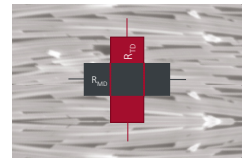
- ▶ Electrical anisotropy refers to a difference in electrical resistance depending on the direction of current flow
- ▶ Wire and mesh structures can have anisotropic resistances
- ▶ Bulk materials with dominant directional characteristics \ effects \ defects can also have electrical anisotropy
- ▶ Anisotropy 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

Measurement technology	Non-contact eddy current sensor with directed current induction
Substrates	Foils, glass, wafer, etc.
Substrate area	29.5" x 25.6" / 750 mm x 650 mm (for 400 mm x 400 mm samples)
Max. Sample thickness / sensor gap	1 / 2 / 5 / 10 / 25 mm (defined by the thickest sample)
Sheet resistance range	0.01 – 1,000 Ohm / sq; 1 to 5 % accuracy
Anisotropy range (TD/MD)	0.33 – 3 (larger on request)
Device dimensions (w/l/h) / weight	30" x 26" x 12" inch / 760 mm x 660 mm x 310 mm / 20 kg
Further available features	Metal thickness measurement, optical transparency and reflection

## Device Control and Software

**Real Time Measurement**

Machine Direction: 28.06% (17.38 Ohm/Sq)

Traverse Direction: 71.94% (44.56 Ohm/Sq)

**87.75% Anisotropy (Absolute)**

Set No of Digits: 0.00

Id	Time	Series N.	Value	Unit
20	10:19:23	Sample 1	1.14e+00	Ohm/Sq
21	10:19:23	Sample 2	1.14e+00	Ohm/Sq
22	10:19:40	Sample 3	1.28e+00	Ohm/Sq
23	10:19:40	Sample 4	1.28e+00	Ohm/Sq