

EddyCus[®] lab 2020A – Anisotropy Tester

P_2020A_25



Highlights

- ▶ Contact-free and real time
- ▶ Accurate single-point measurement
- ▶ Manual mapping guided by easy-to-handle software
- ▶ Measurement of encapsulated layers
- ▶ Characterization of multilayer materials upon request

Applications

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

Device Series

- ▶ Metal layer thickness (nm, μm)
- ▶ Sheet resistance (Ohm/sq)
- ▶ Emissivity
- ▶ Conductivity / resistivity (mOhm·cm)
- ▶ Electrical anisotropy (%)
- ▶ Weight (g/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_3O_4 -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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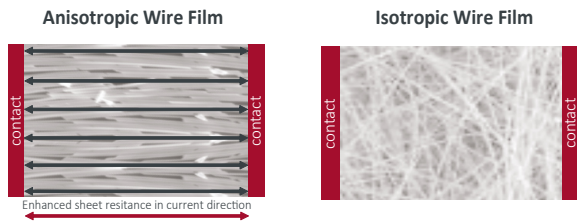
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Anisotropy Term and Concept

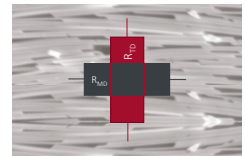
- ▶ Electrical anisotropy refers to a difference in electrical resistance depending on the direction of current flow
- ▶ Wire and mesh structures can have anisotropic resistances
- ▶ Bulk materials with dominant directional characteristics / effects / defects can also have electrical anisotropy
- ▶ Anisotropy 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, e.g. 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	8 inch / 204 mm x 204 mm (open on three sides)
Max. sample thickness / sensor gap	4 / 10 / 14 / 20 mm (defined by the thickest sample)
Sheet resistance range	0.001 – 1,000 Ohm/sq; 1 – 3 % accuracy; < 0.3 – 3% repeatability
Anisotropy range (TD/MD)	0.33 – 3 (larger upon request)
Device dimensions (w/h/d) / weight	11.4" x 5.5" x 17.5" / 290 mm x 140 mm x 445 mm / 10 kg
Further available features	Metal layer thickness, sheet resistance, emissivity, resistivity, weight and drying status and permeability (<i>beta</i>) measurement

Device Control and Software

Real Time Measurement

Machine Direction: 17.38 Ohm/Sq (28.06%)

Traverse Direction: 44.56 Ohm/Sq (71.94%)

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