

High Performance Thin Film Optical Coatings Technical Capabilities

10/21

Coatings Capabilities

Transparent Conductive Coatings

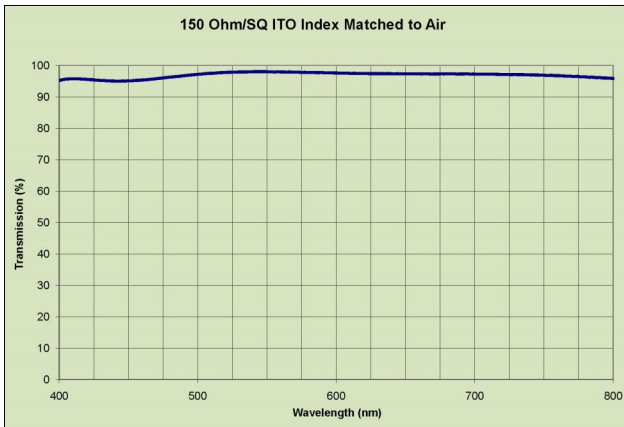
Indium Tin Oxide (ITO) & Index-Matched Indium Tin Oxide (IMITO)

Transparent conductive coatings are very often used in electro-magnetic shielding, electrical heating, and cutting edge display applications. ZC&R uses the coating material indium tin oxide (ITO) which provides for high transmitting durable coatings.

Often, ITO coatings are used in contact with materials other than air. ZC&R often designs and produces ITO coatings designed specifically to be used next to materials such as liquid crystal, cements, index oils, and various other materials. ITO coatings that have been under-coated or over-coated to be index matched to a particular material such as liquid crystal can have very low reflectances.

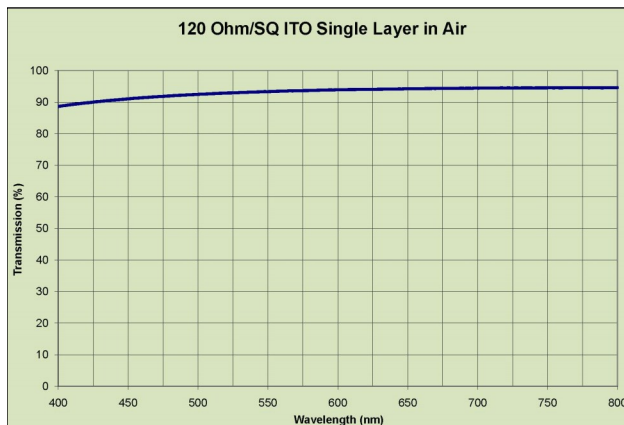
One determining factor as to how low a reflectance can be achieved is the sheet resistivity specification. Thicker ITO layers yield lower sheet resistivities but generally result in higher reflectances. Sheet resistivities as low as 5 to 10 ohms/sq and as high as a few thousand ohms/sq can be achieved. One common thickness of ITO, 100 angstroms, yields approximately 450 ohms/sq.

ZC&R has a great deal of experience coating ITO and index-matched ITO and we would be happy to review any specification requirements you may have, and work with you to determine what can be achieved using ITO coatings for your particular application.



150 ohms/sq Index-Matched ITO in Air

Index-matched ITO (IMITO) provides a combination of low resistivity of 150 ohms/sq and extra transmission in the visible spectrum (400-700nm) with an average transmittance of 94%.



120 ohms/sq ITO Single Layer in Air

This single layer ITO coating provides an average transmittance of 90% over the visible spectrum (400-700nm) with resistivity of 120 ohms/sq. Standard tolerance for sheet resistivity is $\pm 20\%$. Higher or lower resistivities are available upon request.

ZC&R Coatings for Optics

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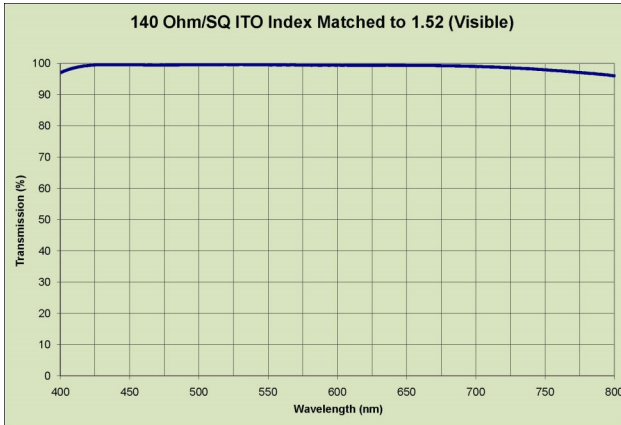
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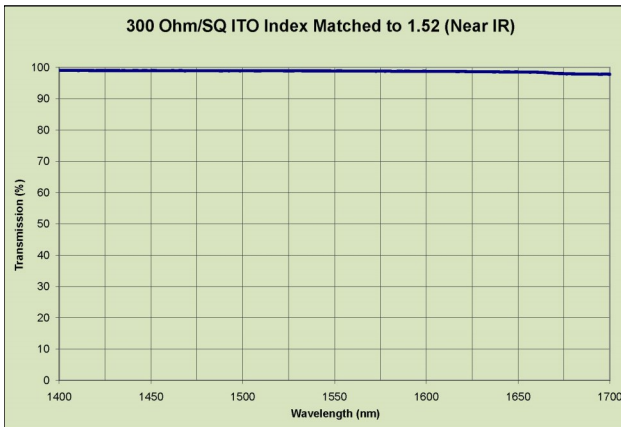
Coatings Capabilities

Indium Tin Oxide (ITO) & Index-Matched Indium Tin Oxide (IMITO) - *continued*



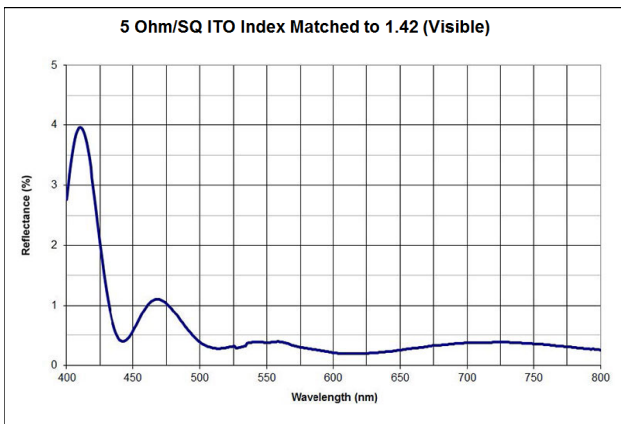
140 ohms/sq ITO Index-Matched to 1.52 (Visible)

This index-matched ITO provides very high transmission average of 97% from 425-675nm, with resistivity of 140 ohms/sq. This coating is index matched to 1.52. Higher or lower resistivities and matching custom indices and multi-layer structures are available on request



Index-Matched ITO for Telecommunications C&L Bands

This index-matched ITO provides very high transmission average of 97% from 1425-1650nm, with resistivity of 300 ohms/sq. This coating is index matched to 1.52. Higher or lower resistivities and matching custom indices and multi-layer structures are available on request.



5 ohms/sq ITO Index-Matched Low Reflectance EMI Shielding for Displays

Photopic* reflectance specified to be less than 1.0% for angles near normal incidence. Typical photopic transmittance is approximately 95%. This coating is designed to be immersed in a laminate. Sheet resistance less than 5 ohms/sq.

* Human eye response in daylight or similar conditions.