

# **COMBINED RIETVELD ANALYSIS OF X-RAY AND NEUTRON DIFFRACTION DATA OF ZINC OXIDE TRANSPARENT CONDUCTORS**

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Transparent conducting oxides (TCOs) are materials that exhibit both high electrical conductivity and optical transparency in the visible region. TCOs are an essential component in opto-electronic devices such as flat-panel displays, photovoltaics and smart windows. These oxides are scientifically interesting since their atomic structure directly affects their electrical and optical properties. X-ray and neutron scattering techniques are crucial for the determination of the atomic structure of these materials. Currently, indium-based oxides dominate the market for TCOs, especially for flat-panel displays. Indium is a toxic metal that is becoming more scarce and expensive due to its high demand. Zinc oxide is an attractive substitute for commercial applications since it is non-toxic and has promising TCO properties. High-resolution x-ray diffraction and time-of-flight neutron diffraction techniques were used to study the effect of impurities and grain size on zinc oxide powders. For each sample, both diffraction data sets were simultaneously analyzed using the Rietveld method. The structural results were correlated with measured electrical properties of these specimens.