

# International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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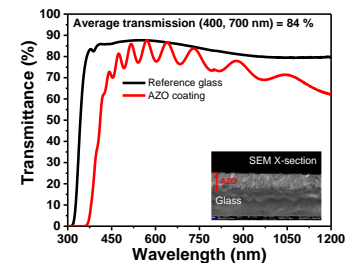
## Development of transparent conducting AZO thin film on large area

### Overview

Al:ZnO (AZO) has emerged as popular transparent conducting electrode material replacing conventional indium tin oxides (Sn:In<sub>2</sub>O<sub>3</sub>) and fluorine doped tin oxide (F:SnO<sub>2</sub>) as non-toxic, cheaper and available in abundance. AZO thin films finds application in wide range of areas such as solar cells, flat panel displays, organic light emitting diodes, gas sensors, photo-catalysis, transistors, and electromagnetic interference shields (EMIS) and piezoelectric devices. Apart from exclusive use in CIGS thin film solar cells, AZO is widely being applied as transparent conducting contact in dye sensitized, perovskite, CdTe and Si based solar cells. DC magnetron systems with cylindrical rotating targets was used for large area deposition, which has advantages of possess high plasma density, faster deposition rate and enables better control over the sputter deposition process, required for high thickness uniformity over large area. Best resistivity and transmittance with high thickness uniformity on 300 mm x 300 mm glass substrate was achieved on the AZO thin films sputtered using optimized process conditions considering technological aspect.

### Key Features

- AZO thin films with high transmittance and conductivity on 300 mm x 300 mm glass substrate
- Highly uniform films (Std deviation 20.65%) with visible light optical transmittance 84% and least resistivity of 4.07 X 10<sup>-4</sup> Ω.cm.
- Figure of merit confirms the suitability of AZO thin films for various optoelectronic device applications as compare to other existing TCO films.



Transmission curve of AZO thin film on glass (Inset: SEM X-Section image)

### Potential Applications

- Solar energy
- Electrical and electronics
- Sensors

### Present Status

- Application development completed

Properties of AZO thin film on glass	Achieved
Thickness	910 nm
Uniformity	2.65 %
Resistivity	4.07E-4 Ω.cm
Transmittance	84%
Adhesion test	Passed

### Technology Readiness Level (TRL)

	1	2	3	4	5	6	7	8	9	10
<b>IPDI*</b>										
<b>Activities</b>	Basic concepts and understanding of underlying scientific principles	Short listing possible applications	Research to prove technical feasibility for targeted application	Coupon level testing in stimulated conditions	Check repeatability/consistency at coupon level	Prototype testing in real-life conditions	Check repeatability/consistency at prototype level	Reassessing feasibility (IP, competition technology, commercial)	Initiate technology transfer	Support in stabilizing production
<b>Status</b>										

\*IPDI : Intellectual Property Development Indices

### Major patents/Publications

1. Transparent conducting Al:ZnO thin film on large area by efficient cylindrical rotating DC magnetron sputtering. Sanjay R. Dhage\* and Amol C. Badgujar, *Journal of Alloys and Compounds* Vol 763, (2018) 504

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