

**AZO**

# Al-doped ZnO nanostructured powder sputtering targets

Define the future of thin film TCO research

## Al-doped ZnO nanostructured powder sputtering targets

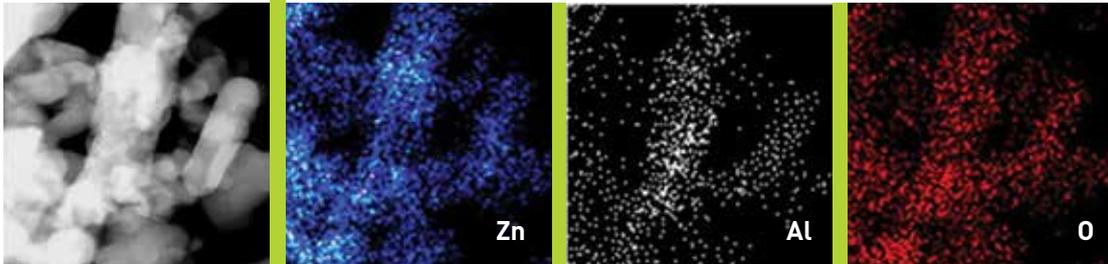
### Break the barriers of thin film research

Innovnano's Al-doped ZnO (AZO) sputtering target discs are produced from our unique nanostructured ceramic powder.

With a higher surface area for increased reactivity, Innovnano's AZO powder enables the production of full density targets at lower sintering temperatures, which minimises grain growth.

Innovnano is one of the only suppliers to ensure a uniform distribution of small secondary phase  $\text{ZnAl}_2\text{O}_4$  grains, contributing to both increased target lifetime and high electrical conductivity. And with smaller grain sizes, our AZO sputtering targets offer better mechanical properties, whilst maintaining desirable thermal characteristics.

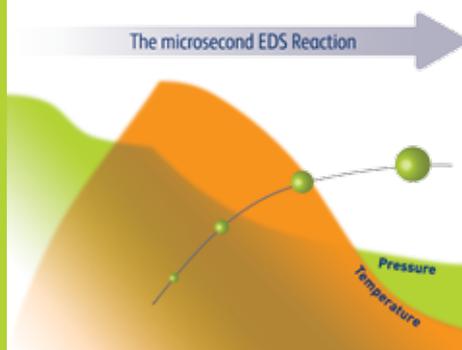
#### Homogeneous AZO powder



TEM images showing uniform distributions of Zn, O and Al in Innovnano's AZO powder

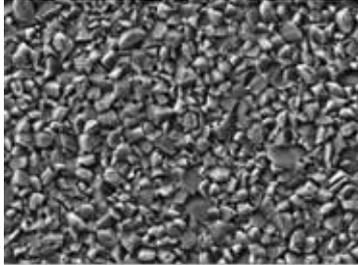
#### Formulated through innovation

Involving a cycle of high temperatures and pressures, Innovnano's proprietary Emulsion Detonation Synthesis (EDS) technology yields an ultrafine AZO nanostructured powder with excellent chemical homogeneity. A variety of Al doping concentrations between 0.5 – 2.0 wt.%  $\text{Al}_2\text{O}_3$  is available for different applications.

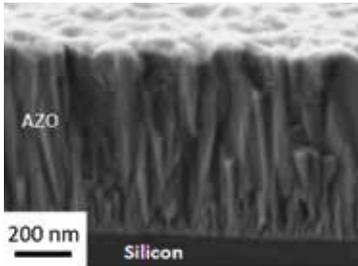


## The ideal sputtering target

The quality of deposited thin films is dependent on the performance of the ceramic sputtering targets. With a small and homogeneous grain size, Innovnano's high-density AZO sputtering targets result in cost effective deposition and most importantly, a superior end-product.



SEM image showing the homogeneous microstructure and reduced porosity of Innovnano's AZO target (composition 98:2 wt. % ZnO:Al<sub>2</sub>O<sub>3</sub>).



SEM image of an AZO thin film with  $\approx 1 \mu\text{m}$  thickness deposited by RF magnetron system from a 98:2 wt% ZnO:Al<sub>2</sub>O<sub>3</sub> AZO target showing a very uniform layer

### Optimum mechanical properties

Robust, full density targets with greatly enhanced mechanical properties and improved plasma stability provide a uniform layer deposition.

### Improved target lifetime

Optimised grain sizes and homogeneous microstructure result in a desirable balance between mechanical and thermal properties, which enables uniform heat dispersion and avoids thermal stress, lengthening the target's lifetime.

### High sputtering efficiency saves time and cost

Innovnano's high density AZO targets result in faster deposition rates, less sputtering time and lower production costs. High mechanical integrity with excellent thermal properties also allows more material to be sputtered from each target.

## High performance thin films

Whatever your research area, from solar cells to displays, Innovnano AZO sputtering targets produce high performance thin films.

**Thin film homogeneity** – Full density, microstructured targets with high electrical conductivity combine to generate a thin deposition layer with uniform thickness and excellent optical, morphological and electrical characteristics.

**Superior conductivity** – Ideal for optoelectronic applications, the absence of nodules and lack of arcing in the targets during deposition ensures superior electrical properties in the sputtered layer, with electrical resistance between  $10^{-3}$  and  $10^{-4} \Omega\text{cm}$ .

**Highly transparent** – High optical transmittance in the visible region for film thicknesses  $> 1 \mu\text{m}$ , makes Innovnano sputter targets ideal for creating TCO material for a wide range of optoelectronic applications.

## Description and applications

Innovnano Al-doped ZnO nanostructured powder sputtering targets can be supplied as 2" and 3" discs. Bonding to a metallic backing plate can be arranged.

Example research applications include:

- Electronic displays
- Touchscreen panels
- Light-emitting diodes (LEDs)
- Photovoltaic cells

### Innovnano AZO target properties

Sputter mode	RF, DC
Target density	$> 5.5 \text{ g.cm}^{-3}$ (> 98 % of theoretical density)
Mean grain size	$< 2 \text{ }\mu\text{m}$
Electrical resistivity (bulk)	$< 1 \times 10^{-3} \text{ }\Omega\text{cm}$
Thermal conductivity (RT)	$36 \text{ W.m}^{-1}\text{K}^{-1}$
Thermal expansion coefficient	$6.5 \times 10^{-6} \text{ }^\circ\text{K}^{-1}$
Appearance	Dark green / greyish
Purity	$\geq 99.9 \%$
Sputter rate	$10 \text{ nm.min}^{-1}$ (under specific conditions)
Doping	Available as 0.5, 1.0, 1.5 and 2.0 wt.% $\text{Al}_2\text{O}_3$

### Lab target dimensions

Nominal dimensions (Diameter x thickness)	50 mm x 3 mm (2" target)
	75 mm x 3 mm (3" target)

### Thin film characteristics\*

Electrical resistivity	$< 5 \times 10^{-4} \text{ }\Omega\text{.cm}$
Transmittance (visible region)	$> 80 \%$ (including glass substrate)

\* Based on AZO 98:2 wt.% ratio and  $\approx 1 \text{ }\mu\text{m}$  film thickness

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