Laser Crystallization of High Performance Gallium Doped Zinc Oxide (GZO) Thin Films

A new method improves gallium-doped zinc oxide film conductivity and transmittance, offering a highly attractive, scalable alternative to expensive and toxic indium tin oxide in optoelectronic devices.

Transparent conducting oxide (TCO) films, which can achieve both electrical conduction and optical transparency, are critical in many large consumer optoelectronic devices such as flat panel displays, photovoltaic cells, light emitting diodes, and electrochromic windows. Until recently, over 90 percent of the TCO market used indium tin oxide (ITO); however, due to indium's toxicity, scarcity, and escalating cost, there is an urgent need to identify alternative TCO films.

Zinc oxides (ZnO) have received attention over the last three decades as a promising substitute for ITO because it is non-toxic, abundant, and inexpensive. Unfortunately, ZnO has high resistivity and unstable electrical properties.

Currently, gallium (GA) doped ZnO (GZO) is under research and development to replace ITO as a transparent conductive coating. Physical vapor deposition is used to manufacture a GZO film with high electron conductivity. In addition, low temperature PVD was used for depositing GZO, but poor optoelectronic properties were obtained. There continues to be an unmet need for improving the electrical conductivity of GZO films so they can compete with ITO films in terms of conductivity.

Purdue University researchers have developed a method of manufacturing GZO films with better structural and optoelectronic properties. This method achieved low resistance and high transmittance, making it attractive for large-scale manufacturing. There are potential applications with other metal oxides and other deposition methods, such as sol-gel, printing, and spray coating.

Advantages:

Technology ID
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Category
Semiconductors/Devices & Components
Materials Science & Nanotechnology/Nanomaterials & Nanostructures

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-High conductivity and transmittance

-Large-scale manufacturing

Potential Applications:

-Flat panel display

-Photovoltaic cells

-Light emitting diodes

-Sol-gel

-Printing

-Spray coating

TRL: 4

Intellectual Property:

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