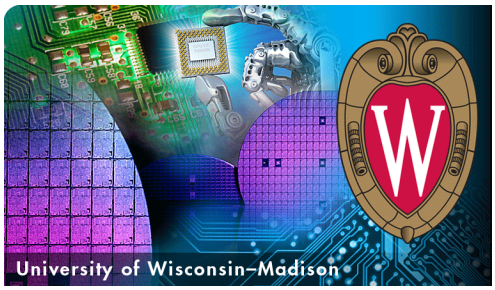

Thin Metal Oxide Films for Transparent and Flexible Electronics

INVENTORS • Xudong Wang, Zhenqiang Ma, Fei Wang, Jung-Hun Seo

WARF: P100129US01

View U.S. Patent No. 8,502,218 in PDF format.

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing thin film membranes made of zinc oxide for semiconductor applications.

OVERVIEW

Silicon is a major component in semiconductors due to its good electrical properties, reasonable cost and manufacturability. Zinc oxide is promising as a semiconductive material because it has a large bandgap (providing high power) and high exciton binding energy (a relatively large amount of energy is needed to free electrons from electron-hole pairs, for potential high temperature luminescence). Zinc oxide also is a direct bandgap material (for potential light-emitting devices), and is abundant and inexpensive as compared to silicon.

Unfortunately, the techniques used for silicon thin film manufacturing cannot be applied to metal oxide films. Many metal oxide single-crystalline films, including zinc oxide films, can be grown on a solid substrate, but no known chemical etchants are able to selectively remove the substrate and allow for transferring the film. Films of polycrystalline metal oxides may be formed using processes such as sputter deposition and chemical vapor deposition, but the resulting polycrystalline films lack the desirable semiconducting properties of single-crystalline metal oxide films. A need exists for a method of generating single-crystalline zinc oxide thin films that are transferrable.

THE INVENTION

UW-Madison researchers have developed a continuous, free-standing metal oxide film and a method of making such films. The method produces zinc oxide nanomembranes with large areas through film synthesis on a water surface. A wetting agent forms a planar template on the water surface and attracts zinc cations contained in the water to the surface. The template expands over the water surface during formation and results in growth of a large zinc oxide membrane. The membrane floats on the water surface and can be transferred easily onto a variety of substrates, allowing for use in a variety of applications. The single-crystalline structure of the continuous metal oxide film aligns either in a hexagonal or rectangular pattern depending on temperature and growth time. The single-crystalline structure provides the desirable semiconducting properties

THE WARF ADVANTAGE

Since its founding in 1925 as the patenting and licensing organization for the University of Wisconsin-Madison, WARF has been working with business and industry to transform university research into products that benefit society. WARF intellectual property managers and licensing staff members are leaders in the field of university-based technology transfer. They are familiar with the intricacies of patenting, have worked with researchers in relevant disciplines, understand industries and markets, and have negotiated innovative licensing strategies to meet the individual needs of business clients.

unavailable in current polycrystalline metal oxide films.

APPLICATIONS

- Transparent electrodes
- Light-emitting diodes
- Flexible, high-frequency electronics
- Solar panels

KEY BENEFITS

- Provides only technology capable of producing single-crystalline zinc oxide thin films
- Enables easy, roll-to-roll manufacturing of large area membranes

ADDITIONAL INFORMATION

Related Technologies

For more information about fabricating semiconductor devices with single-crystalline membranes, see WARF reference number P06047US.
For more information about fabricating high-speed thin-film transistors on flexible membranes, see WARF reference number P06456US.

Publications

Read a news article about this technology.

Tech Fields

Semiconductors & Integrated Circuits - Components & materials

CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842.