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Battelle Number(s):

11694, 12808

Patent(s) Issued

Available for licensing in all fields

Awards Won:

R&D 100 Award - 2000

U.S. DEPARTMENT OF ENERGY

Available Technologies

Transparent Conductive Thin-Film Materials

SUMMARY

Patented approaches for synthesizing thin-films having both high levels of transparency and conductivity have been developed. The first of these approaches is a method for reducing the charge state of a dopant in a metal oxide film that produces a film in which the dopant is reduced while the metal oxide is not. This relatively simple technique produces a thin film that is both optically transparent and highly conductive.

The second patented approach involves oxide materials with a spinel crystal structure. For example, a transparent conductive oxide (TCO) 3-layer film between 2.5 and 15 µm film consisting of an oxide of cobalt and nickel was produced that exhibits electrical conductivities as high as 20 S-cm-1 for a single-layer 20nm thick film, and transmissivities between 70 and 90%. The films are somewhat absorbent at shorter wavelengths, with single-layer film transmission decreasing from 70% at 0.8 pm to 40% at 0.3 µm. Another spinel oxide composition containing Pd and Ni, was found to have similarly desirable electronic and optical properties. These TCO films may be deposited using either solution deposition or sputtering methods. Deposition by sputtering has been demonstrated to substantially improve the films' conductivity. The films are highly uniform, as shown by SEM at magnifications as high as 10,000X.

STATE OF DEVELOPMENT & AVAILABILITY

Potential applications available for licensing include: * Optical coatings for flat panel displays, infrared sensors, and solar cells.

* Optical limiters and switches.

* Devices that rely on the non-linear optical response of their components.

* Photovoltaic-powered electrochromic devices, including electrochromic windows.

RELATED LINKS

» **Conducting spinel oxide films with infrared transparency**
2002, Elsevier Science B.V., Thin Solid Films; Charles F. Windisch, Jr., Kim F. Ferris, Gregory J. Exarhos, Shiv K. Sharma
http://dx.doi.org/10.1016/S0040-6090(02)00740-X

» **Process enhanced polaron conductivity of infrared transparent nickel-cobalt oxide**
2005, Elsevier B.V., Thin Solid Films; R.R. Owings, G.J. Exarhos, C.F. Windisch, P.H. Holloway, J.G. Wen
http://dx.doi.org/10.1016/j.tsf.2005.01.011

Patents & Intellectual Property

- Patent #: 5,990,416
- Patent #: 6,761,985
- Patent #: 7,011,732

Technology Portfolio(s)

- Materials Synthesis and Functionalization

Potential Industry Applications

- Chemicals
- Computers & Electronics

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