ARRADIANCE ***Sneak Preview***

Room Temperature Pulsed Laser Deposition of Aluminum Zinc Oxide (AZO): Enabling Scalable Indium-Free Transparent Conductive Oxides

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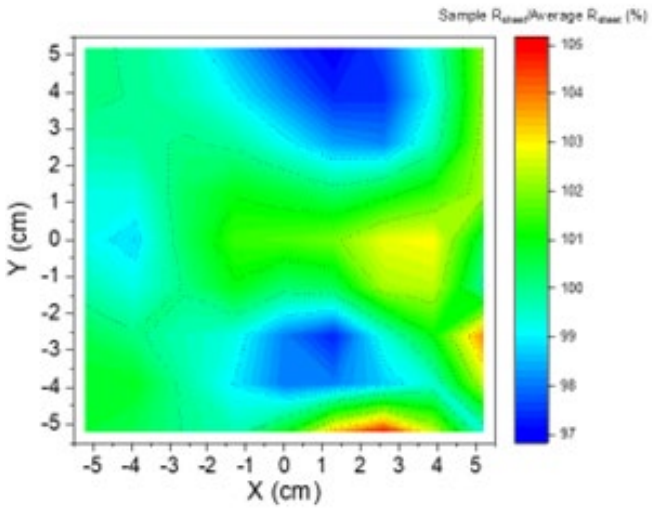
Solar cells and displays require the use of transparent conducting oxides (TCOs) that allow electrical connectivity while allowing light to pass through. The dominant TCO currently in use is indium tin oxide (ITO). While this has served the industry for many years, indium is costly, and supplies are limited because it is extracted as a byproduct from smelting certain zinc and copper ores. Aluminum-doped zinc oxide (AZO) is a promising alternative TCO although some challenges to its use remain, particularly environmental stability and deposition uniformity.

A study from the University of Valencia used AZO to replace ITO in a perovskite solar cell. AZO and perovskite materials are moisture sensitive, so the authors deposited a 20 nm layer of SnO_2 by ALD in a GEMStar™ system as a moisture barrier and as a carrier transport layer. This study used pulsed laser deposition (PLD) to deposit AZO, achieving a good electrical conductivity uniformity of 3.5% on a 11x11 cm square and electrical conductivity of $5.5 \cdot 10^{-4}$ Ωcm.



A map of the electrical resistivity of the deposited AZO

The overall power conversion efficiency of the cells was 18.5% with AZO as the top current collector, and 80% of this efficiency was retained after 1800 hours at 85 °C. This indicates that the SnO_2 moisture barrier provided good protection to the AZO and the perovskite material, both of which are easily damaged by exposure to water vapor, bringing perovskite solar cells closer to commercial viability.

Arradiance systems are capable of depositing AZO and SnO_2. Arradiance offers a glovebox interface, facilitating ALD on moisture sensitive materials including those used in solar applications. For more information on Arradiance® Technology, ALD Systems or Foundry Services, please contact Arradiance.

Joost W. C. Reinders, Jons Bolding, Cristina Roldán-Carmona, Federico Ventosinos, Abhyuday Paliwal, Lidón Gil-Escrig, Francisco Palazon, Michele Sessolo, Kassio P. S. Zanoni and Henk J. Bolink, Room Temperature Pulsed Laser Deposition of Aluminum Zinc Oxide (AZO): Enabling Scalable Indium-Free Transparent Conductive Oxides. Advanced Functional Materials, https://doi.org/10.1002/adfm.202418069