Docket #: S22-193

Open-air ultrasonic spray combustion deposition and rapid plasma curing of metal oxides

Researchers at Stanford have developed a next-generation technique of fabricating metal oxide thin films using open-air ultrasonic spray combustion and plasma curing. Conducting oxides (TCOs), in particular Indium tin oxide (ITO), are pivotal for manufacturing of electronic devices, photovoltaics and solar cells. However, the manufacturing techniques remain time-intensive and low-throughput for large-scale production of TCOs via traditional vacuum-based deposition (i.e., sputtering).

The scientists at Stanford developed a novel open-air and scalable TCO synthesis technique that is time-efficient, highly tunable, and environmentally friendly. The chloride-free combustion synthesis uses an open-air ultrasonic spray or other solution casting technique to deposit the coating, and then anneals rapidly to generate an amorphous or crystalline oxide depending on the curing temperature. Then, an open-air plasma is used to tune the film conductivity. This method gives high throughput, requires low temperature deposition for amorphous oxide generation, and simultaneously achieves high conductivity. This technique significantly reduces the cost of fabrication of TCO and improves the efficiency of production without sacrificing for its conductivity.

Stage of Development
Proof of Concept

Related Technologies from Dauskardt Lab:
Stanford Docket - S23-173 Open-air, rapid plasma annealing of solution deposited solid-state electrolytes for lithium batteries

Stanford Docket - S23-073 Fast and efficient method to produce highly ordered, mesoporous, metal oxide thin films from solution combustion synthesis

Stanford Docket - S23-234 t-Butyl ester-containing complexing agents for ultra-low temperature, solution processable metal oxide formation via combustion

Applications

- As an improvement to the present thin film conducting oxides, such as thin film conductors, OLEDS, photovoltaics, plasma display, dielectrics, and other consumer electronics
- As infrared mirrors for window treatment to improve heating and cooling capacity
- As electrodes in thin film solar cells

Advantages

- Fully open-air fabrication process
- Time-efficient, low-cost manufacturing technique
- In situ production process
- Free of corrosive halide by-products

Patents

- Published Application: 20230407475

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