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Method of preparing nickel and indium tin oxide as transparent conductive oxide layer



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TECHNOLOGY READINESS LEVEL (TRL)

- TRL 4

PATENT/ GRANTED NUMBER

- PI 2014702859

▶ TECHNOLOGY OVERVIEW

The present invention provides a method to fabricate transparent conductive oxide (TCO) layer with nickel / indium tin oxide nanocolumnar via radio frequency (RF) magnetron sputtering method. In this system nickel (Ni) and indium tin oxide (ITO) targets are deposited on glass or silicon substrates. The use of Ni functions as a seed layer and also as catalyst during the growth process. The Ni and ITO is deposited at temperature of 200°C and pressure at 5 mTorr using RF power of 50 W and 200 W, respectively and sputtering process time of 3 minutes and 60 minutes, respectively. Throughout the sputtering process, the substrate holder is continuously rotated at 8 RPM to ensure uniformity surface of the Ni/ITO TCO layer. The nanocolumnar structure of Ni/ITO improves TCO layer because it decreases the total internal reflection that occur in the Ni/ITO TCO layer.

The transmittance of the Ni/ITO TCO layer is more than 90% in the visible region, and the resistivity is lower, at approximately $\sim 1.0 \times 10^{-6} \Omega\text{cm}$. This means that the conductivity of Ni/ITO TCO layer is very high and such, the current spreading will be enhanced on the devices structure when applied the voltage which will particularly enhance light extraction efficiency (LEE) of devices such as LED. As such, this will improve the efficiency of the LED while enables easy and low fabrication cost in LED manufacturing. This TCO can be further utilized in photovoltaics applications which include inorganic devices, organic devices and dye-sensitized solar cell, such as LED, solar cells, and gas sensor.

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