

Direct indium-tin-oxide patterning using thermal nanoimprint lithography and ITO nano-particle solution

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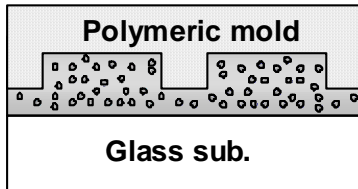
Indium-tin-oxide (ITO) is the most widely used transparent conducting oxide (TCO) material on account of its high transmittance and high conductivity. In order to improve the efficiency of optoelectronics using TCO materials, there is a need to improve the transmittance and resistivity of the TCO layers. Recently, transmittance improvement techniques, which aim reduces the total internal reflectance at the interface with air ambient using nanostructures on the surface have attracted considerable research attention. ^{1, 2}

In this study, direct ITO nano patterning techniques were developed using thermal nanoimprint lithography (NIL) with an ITO nano-particle solution. Fig. 1 is a schematic procedure of direct ITO patterning process. At first, ITO nano particle solution was spin-coated on the substrate. Then, a PDMS mold was put on the substrate and thermal NIL was progressed at 5atm, 200°C for 1h. After imprinting process, the PDMS mold was de-tached and the substrate with ITO nano particle patterns was annealed at 500°C for 1h in vacuum ambient. Fig. 2 is SEM micrographs of the directly patterned ITO layer on the glass substrate. As shown in Fig. 2, the sub-micron sized ITO nano patterns were clearly formed on the substrate. And the optical properties of the ITO glass and the LED device with the directly patterned ITO layer were characterized by UV-VIS-NIR and PL spectroscopy.

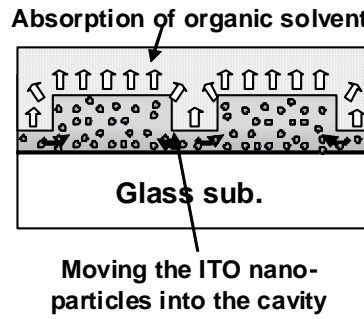
¹ D. S. Leem, T. Lee and T. Y. Seong, *Solid-State Electron.*, 51, 793 (2007)

² J. Krč, M. Zeman, F. Smole and M. Topič, *J. Appl. Phys.*, 92, 749 (2002)

1. Spin-coating & loading



2. Nanoimprint Lithography



3. De-molding



4. Annealing

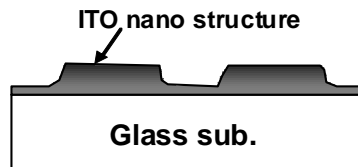


Fig. 1 Schematic diagram of direct ITO nano patterning using thermal NIL with ITO nano particle solution.

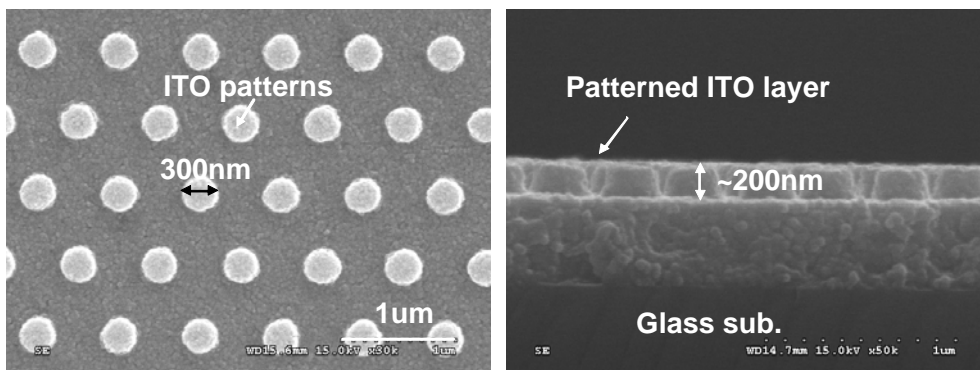


Fig. 2 SEM micrographs of directly patterned ITO layer on the glass substrate.