

Ni-assisted growth of transparent and single crystalline indium-tin-oxide nanowires

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Single crystalline indium-tin-oxide (ITO) nanowires (NWs) were grown by sputtering method. A thin Ni film of 5 nm was deposited before ITO sputtering. Thermal treatment forms Ni nanoparticles, which act as templates to diffuse Ni into the sputtered ITO layer to grow single crystalline ITO NWs. This Ni diffusion through an ITO NW was investigated by transmission electron microscope to observe the Ni-tip sitting on a single crystalline ITO NW. Meanwhile, a single crystalline ITO structure was found at bottom and body part of a single ITO NW without remaining of Ni atoms. This indicates the Ni atoms diffuse through the oxygen vacancies of ITO structure.

Rapid thermal process (RTP) applied to generate an initial stage of a formation of Ni nanoparticles with variation in time periods to demonstrate the existence of an optimum condition to initiate ITO NW growth. Modulation in ITO sputtering condition was applied to verify the ITO NW growth or the ITO film growth. The Ni-assisted grown ITO layer has an improved electrical conductivity while maintaining a similar transmittance value to that of a single ITO layer. Electrically conductive and optically transparent nanowire-coated surface morphology would provide a great opportunity for various photoelectric devices.

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