Electronic Supplementary Information

Universal value of effective annealing time for rapid oxide nucleation and growth under pulsed ultraviolet laser

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Time-resolved resistance measurements for the ITO thin films at each KrF laser pulse were conducted with a digital phosphor oscilloscope (DPO3054, Textronix). The current at 1 mA was applied to the circuit, and the voltage variations were probed by the oscilloscope. The measurement timing of the resistance curves was synchronized with the KrF laser pulse probed by a photodetector (FPS-10, Ophir Optronics) from split laser beam. At the same time, the pulse shape of the lasers was monitored with the oscilloscope from the photodetector signal.

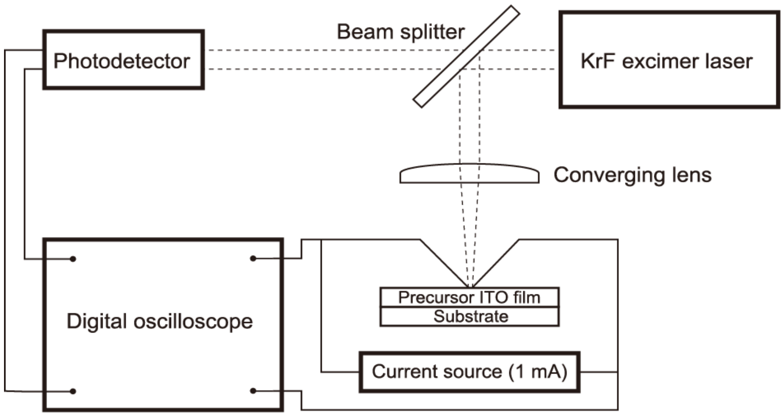

Figure S1. Schematic measurement system for the time-resolved resistance and laser pulse shape..

The ITO thin film obtained by the ELAMOD process showed a semiconducting behaviour, and it was fitted well by using variable range hopping (VRH) model ($\sigma = A\exp[-(T_0/T)^{1/4}]$) above 160 K (Fig. S2(a)). The resistivity reduction at 800 ºC compared to the value at room temperature (20 ºC) was evaluated to be –33% from the extrapolated VRH fitting curve (Fig. S2(b)). This reduction is comparable with the resistivity drop during pulsed laser instantaneous heating at 10,000th pulse (Fig. 8).

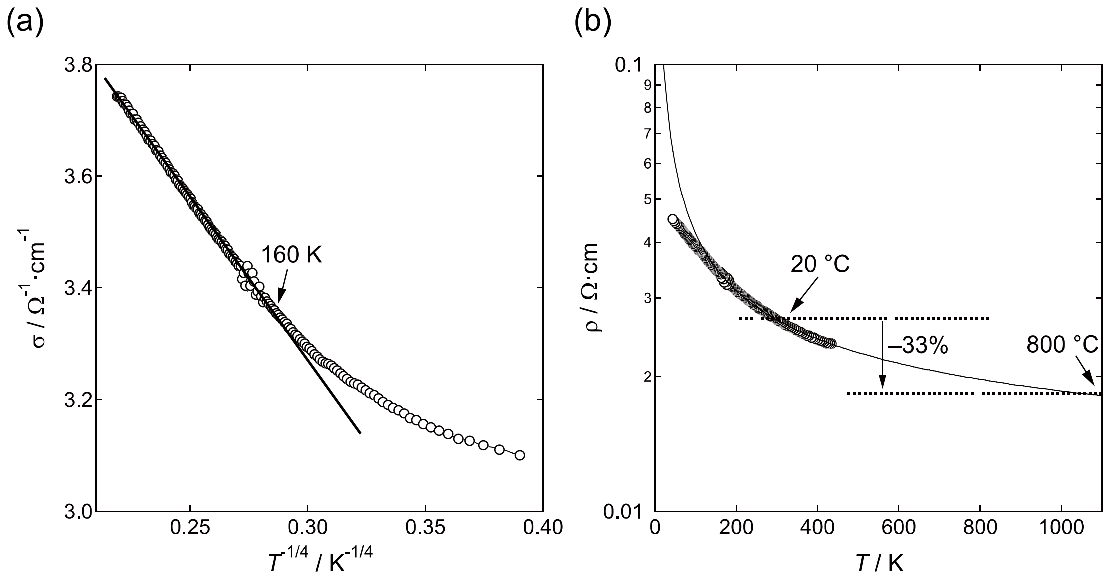

Figure S2. (a) Electrical conductivity of the ITO film obtained by the ELAMOD process as a function of $T^{-1/4}$. The solid line is fitted by using VRH model. (b) Observed electrical resistivity of the ITO film and fitted curve using obtained parameters in (a).