Supplementary Information

Indium Hydroxide Ceramic Targets: A Breakthrough in High-Mobility Thin-Film Transistor Technology

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#Contributed equally

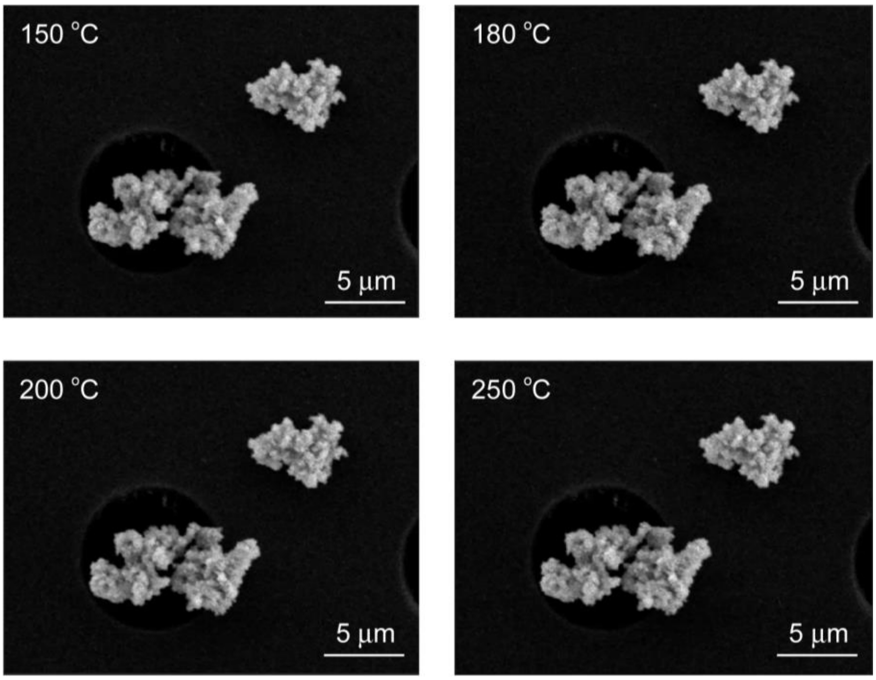


Figure S1. High-temperature SEM images of $In(OH)_3$ powder. The overall shape of the $In(OH)_3$ powder did not change up to 250 °C.

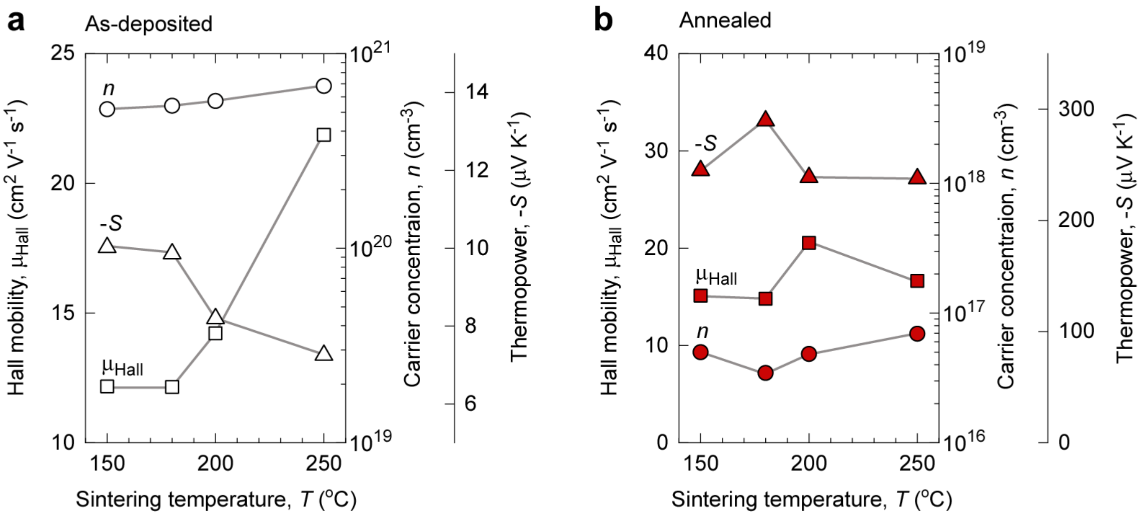
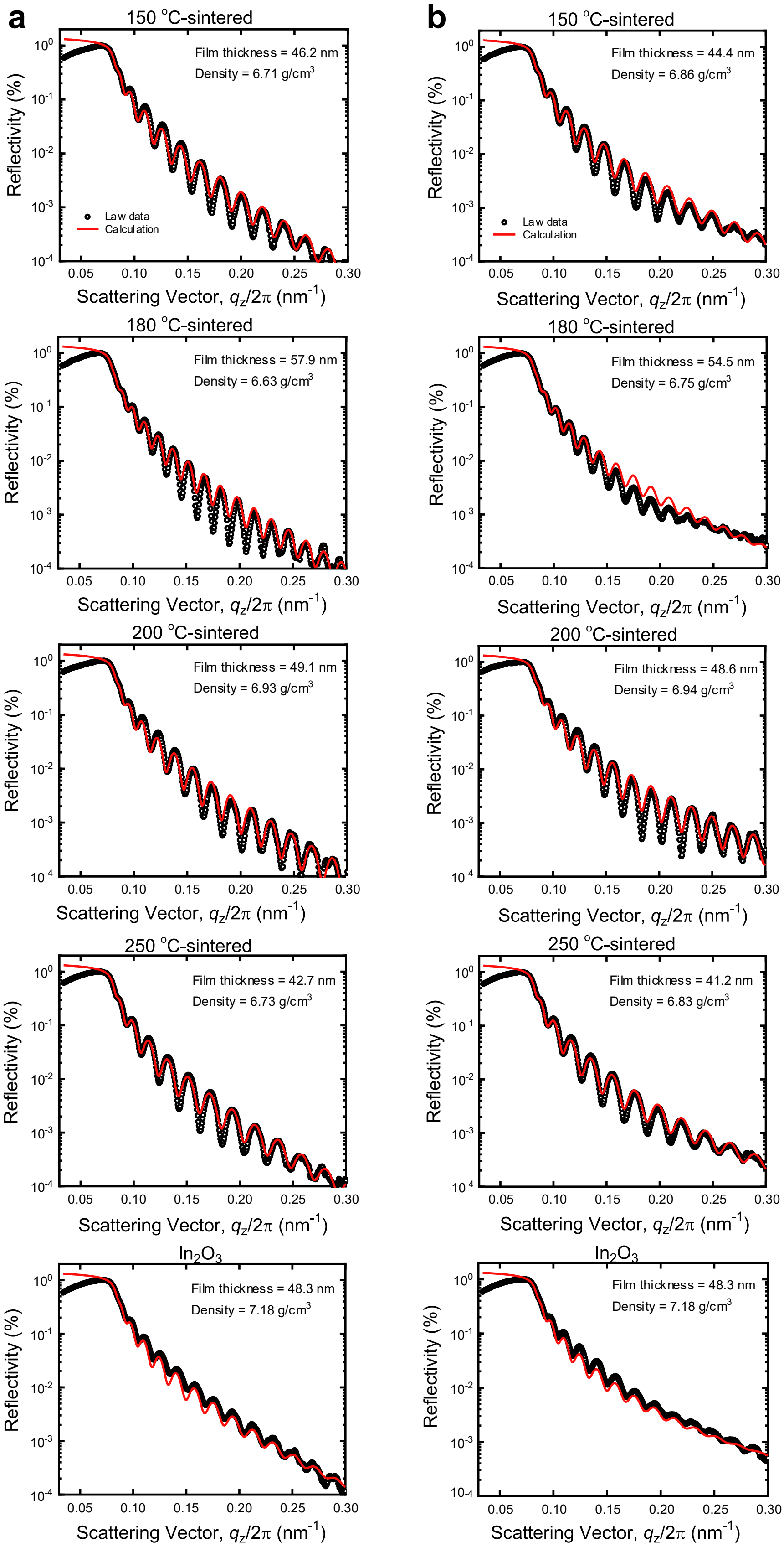


Figure S2. Electron transport properties of the resultant films measured at room temperature. The figure compares the carrier concentration (*n*), Hall mobility (μ_{Hall}), and thermopower (*S*) between (a) as-deposited and (b) 300 °C-annealed films.



a
b
150 °C-sintered
Film thickness = 46.2 nm
Density = 6.71 g/cm3
Law data
Calculation
Film thickness = 44.4 nm
Density = 6.86 g/cm3
180 °C-sintered
Film thickness = 57.9 nm
Density = 6.63 g/cm3
Film thickness = 54.5 nm
Density = 6.75 g/cm3
200 °C-sintered
Film thickness = 49.1 nm
Density = 6.93 g/cm3
Film thickness = 48.6 nm
Density = 6.94 g/cm3
250 °C-sintered
Film thickness = 42.7 nm
Density = 6.73 g/cm3
Film thickness = 41.2 nm
Density = 6.83 g/cm3
In2O3
Film thickness = 48.3 nm
Density = 7.18 g/cm3
Reflectivity (%)
Scattering Vector, qz/2π (nm-1)

Figure S3. Bulk density of the films using $In(OH)_3$ ceramic targets. X-ray reflectivity (XRR) measurements of films. (a) As-deposited and (b) 300 °C-annealed. After annealing, the film density increased for those deposited from $In(OH)_3$ ceramic targets.

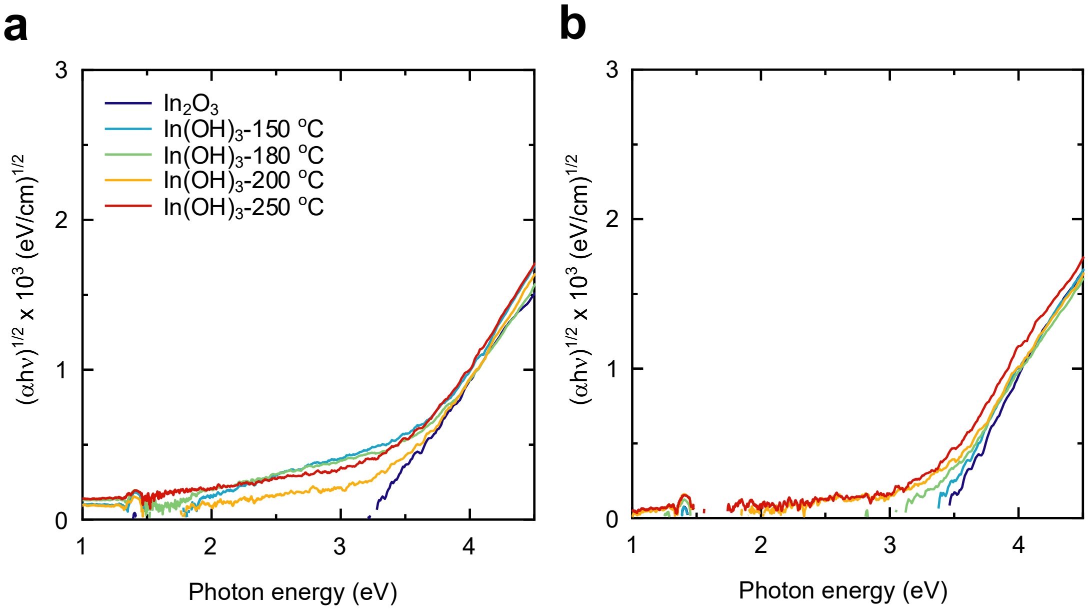


Figure S4. Optical bandgap of the films using $In(OH)_3$ ceramic targets. Optical bandgap values calculated from optical absorption measurements for the films. The bandgap was determined using Tauc plots derived from the absorption spectra. (a) The as-deposited films show bandgaps of 3.25 eV, 3.12 eV, 3.16 eV, 3.23 eV and 3.13 eV for the In_2O_3 ceramic target, 150 °C, 180 °C, 200 °C, and 250 °C-sintered $In(OH)_3$ target, respectively. (b) The 300 °C-annealed films show bandgaps of 3.37 eV, 3.34 eV, 3.27 eV, 3.29 eV and 3.23 eV for the In_2O_3 ceramic target, 150 °C, 180 °C, 200 °C, and 250 °C-sintered $In(OH)_3$ target, respectively.

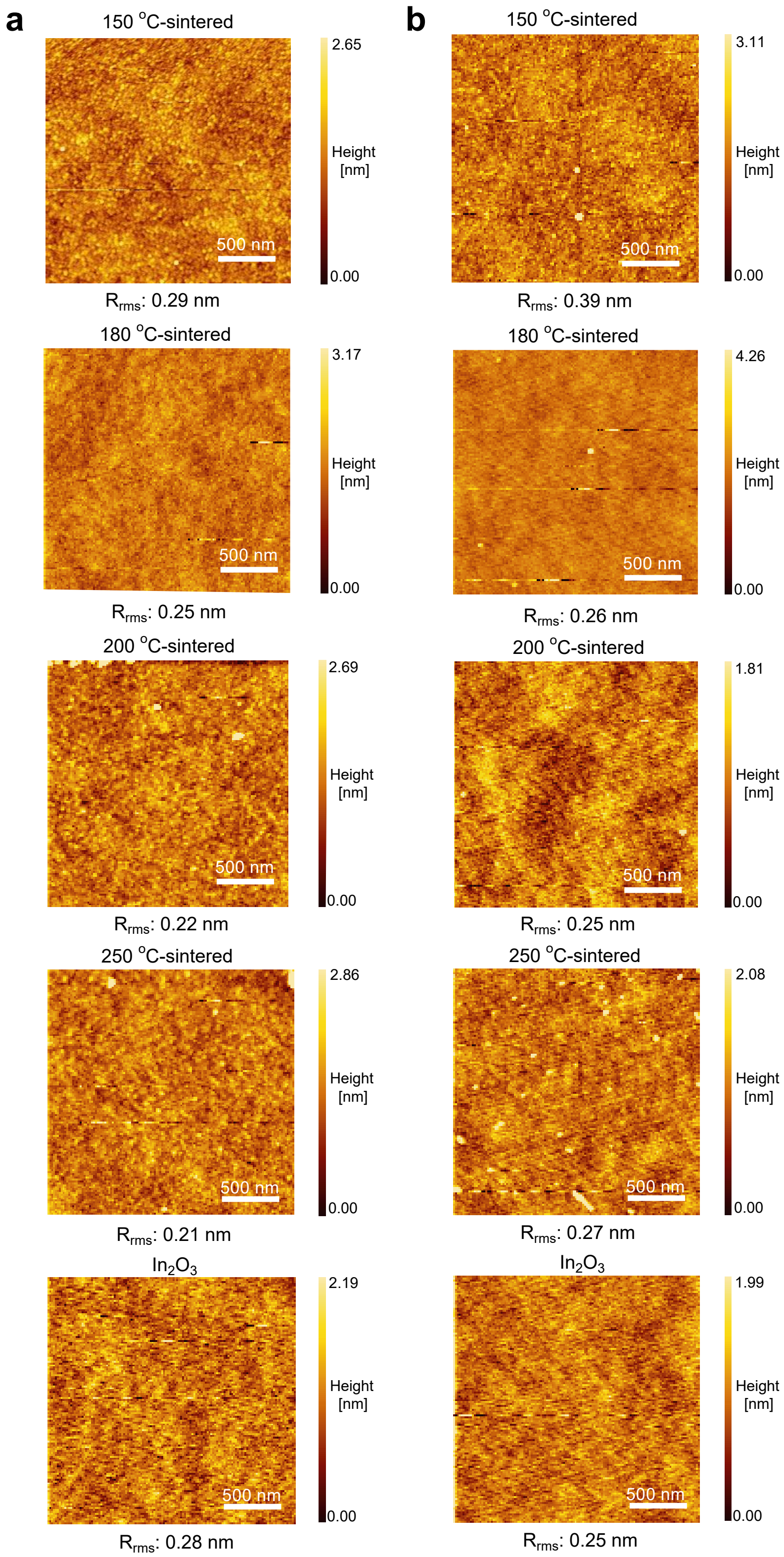


Figure S5. Topographic AFM images of the films using $In(OH)_3$ ceramic targets.

Atomic force microscopy (AFM) images of (a) as-deposited and (b) 300 °C-annealed films deposited from $In(OH)_3$ and In_2O_3 ceramic targets. The surface morphology remains relatively smooth before and after annealing, with low root-mean-square roughness (R_{rms}). The scale bar represents 500 nm.

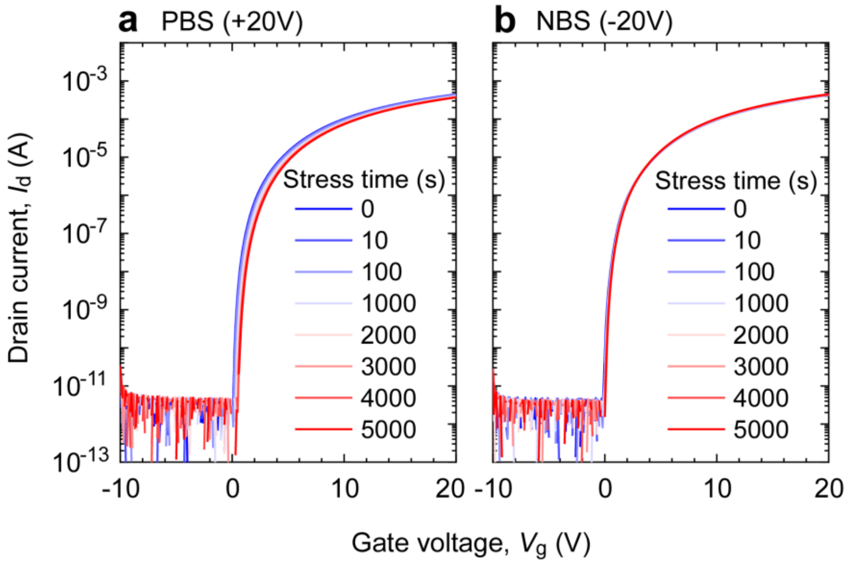


Figure S6. Bias stress stability test of the resultant In_2O_3 TFTs fabricated using the $In(OH)_3$ ceramic target. (a) Positive bias stress (PBS: $V_g = +20$ V), (b) negative bias stress (NBS: $V_g = -20$ V). The threshold voltage (V_{th}) shifts after 5000 s of PBS and 5000 s of NBS were negligible, indicating the high reliability of the In_2O_3 TFT fablicated using $In(OH)_3$ ceramic target.