Supporting Information

Tailoring oxygen vacancies in Ni-doped In_2O_3 for improved thin-film transistor stability and performance via solution processing

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Characterizations

X-ray diffraction, (XRD, Smart Lab 9 KW) was used to investigate the microstructure of NiInO films, providing insights into their crystallinity and phase composition. Ultraviolet-visible spectroscopy (UV, Shimadzu UV-2550) was conducted to analyze the bandgap and transmittance spectra of the NiInO films, revealing changes in optical properties. Thermogravimetric behavior was obtained by a thermogravimetric analyzer (TGA, STA449F3). The chemical bonding states and composition were investigated by XPS (ESCALAB 250Xi). The surface morphology of NiInO thin films was studied using AFM (Bruker Multimode 8). Finally, the electrical characteristics of the Si/SiO_2/NiInO thin-film transistors (TFTs) were measured using an (Agilent B1500A) semiconductor device analyzer in the dark, allowing for accurate assessment of the device's current-voltage behavior and performance.

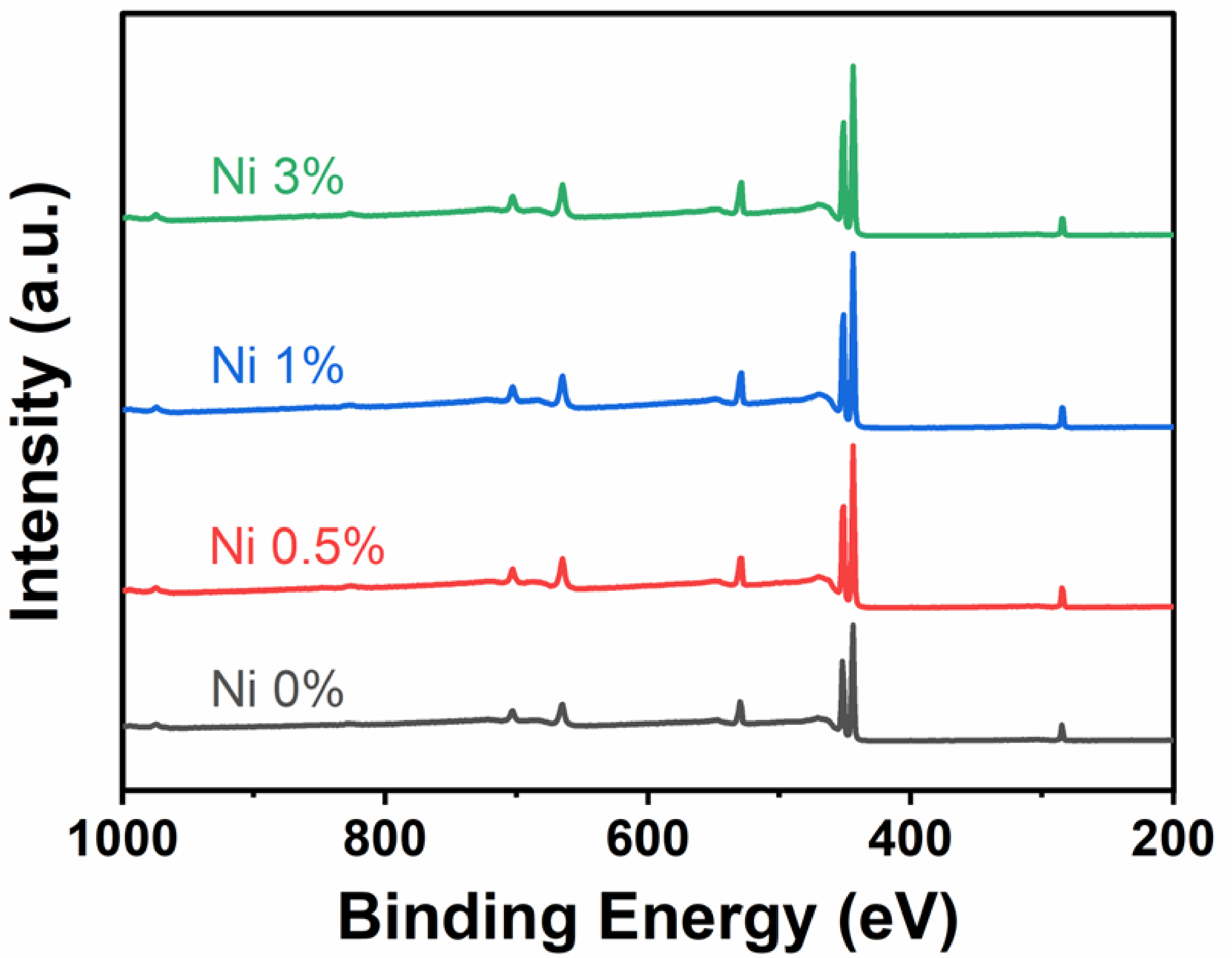


Fig. S1 Survey XPS spectra of Ni-doped In_2O_3.

Note: As the Ni concentration increases, certain peaks in the spectra either become more intense or shift, indicating changes in the sample's chemical composition or electronic structure. The peaks at specific binding energies suggest the presence of Ni-related chemical states, especially for the higher concentrations (1% and 3%).

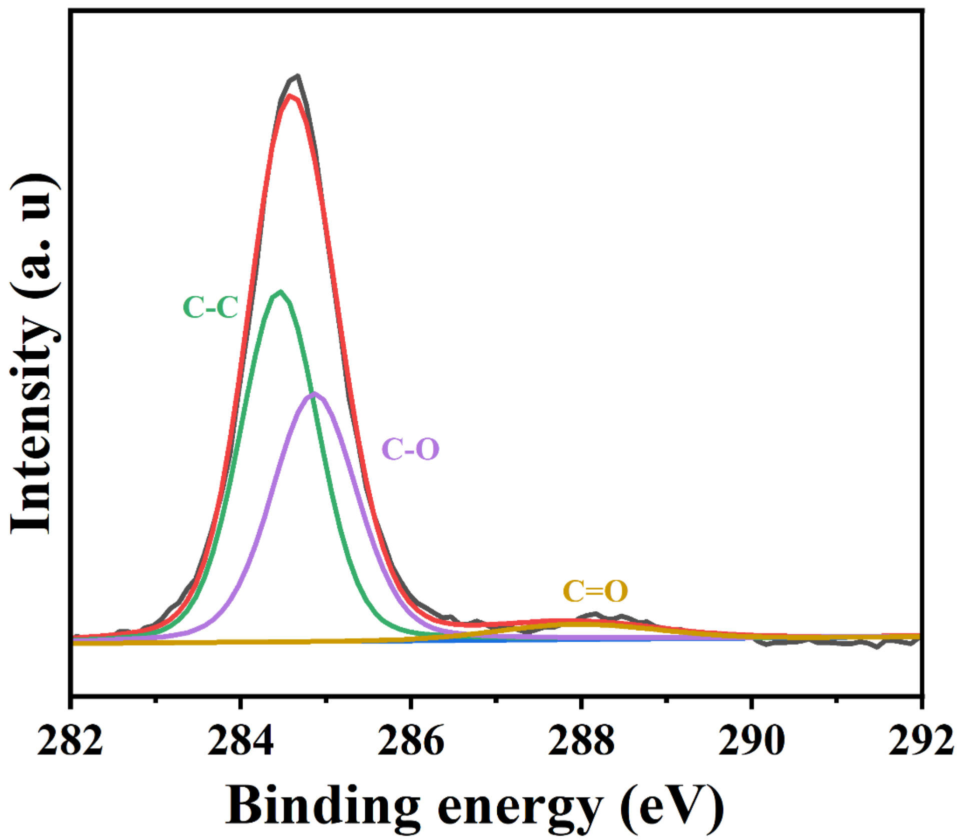
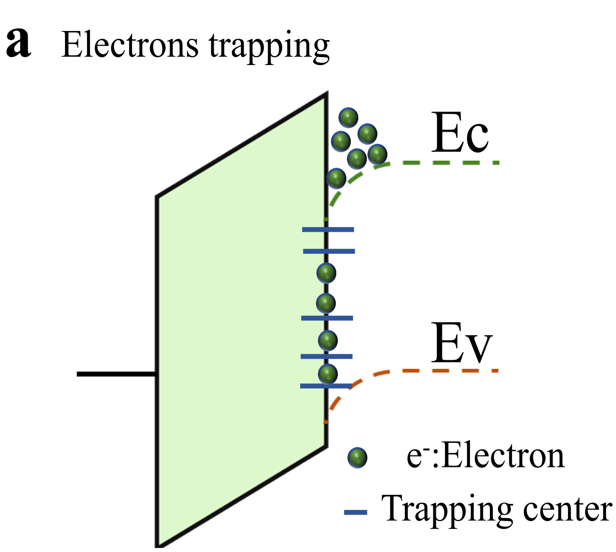


Fig. S2 C1s XPS spectra of Ni-doped In_2O_3.



Figs. S3 Schematic energy band diagram **(a)** NiInO TFTs for PBS **(b)** NiInO TFTs for NBS

Table S1. Electronegativity, strength of Lewis acid elements, and strength of oxide metal bonding.

Elements	Electronegativity	Lewis's acid strength	Bond strength of metal-oxygen (kJ/mol)
In^{+3}	1.45	1.03	320.1
Ba^{2+}	1.00	1.16	502.9
Y^{3+}	1.21	1.47	549.5
Ga^{3+}	1.56	1.17	353.5
Se^{3+}	1.32	1.70	681.6
Gd^{3+}	1.27	0.79	719.0
Sb^{5+}	1.76	3.56	434.3
Hf^{4+}	1.57	1.46	801.7
La^{3+}	1.21	0.85	799.0
Sr^{2+}	1.00	1.42	549.5
Ni^{2+}	1.37	3.48	360.0