

## Supporting Information

Indium Sulfide and Indium Oxide Thin Films Spin-Coated from Triethylammonium Indium Thioacetate Precursor for *n*-Channel Thin Film Transistor

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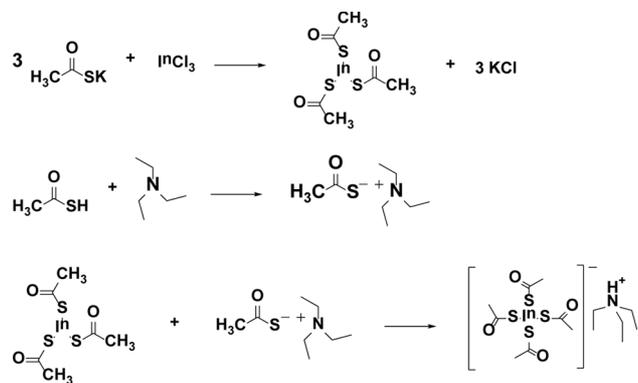
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## Experiment

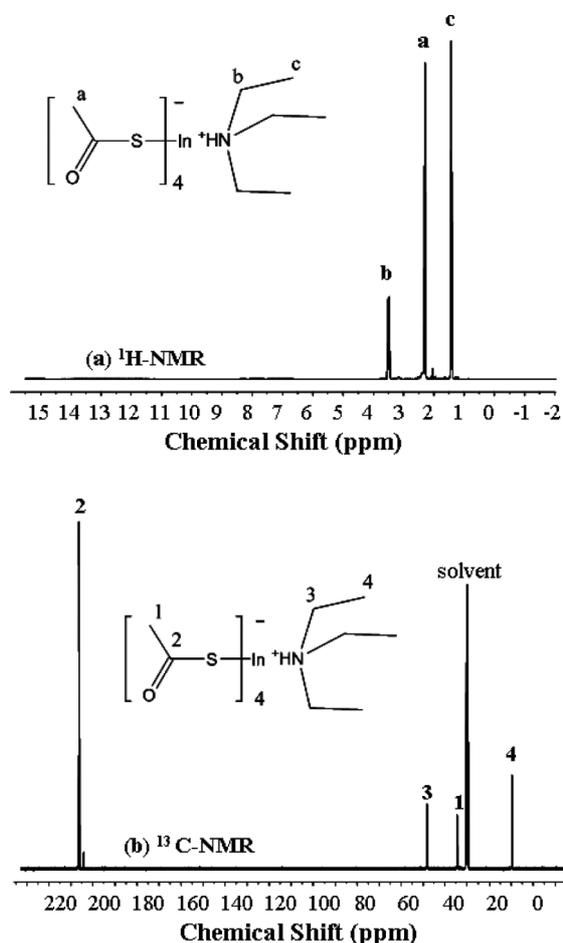
All reagents were supplied by Aldrich Chemical Co. (St. Louis, MO, USA): thioacetic acid ( $\text{CH}_3\text{COSH}$ , 96%), potassium thioacetate ( $\text{KS}(\text{CO})\text{CH}_3$ ), Indium chloride ( $\text{InCl}_3$ ), triethylamine ( $(\text{Et})_3\text{N}$ ), and the solvents methylene chloride (MC) and acetone nitride.

The organometallic precursor, triethylammonium indium thioacetate ( $[(\text{Et})_3\text{NH}]^+ [\text{In}(\text{SCOCH}_3)_4]^-$ ; TEA-InTAA), was synthesized following the procedure described by J.Vittal's Group<sup>1</sup> with small modifications. Indium thioacetate was synthesized by mixing 0.25 mmol of  $\text{InCl}_3$  and 0.25 mmol of  $\text{KS}(\text{CO})\text{CH}_3$  in 15 mL of water, stirring for 1 h. Triethylammonium thioacetate was synthesized by the reaction of 0.25 mmol of  $(\text{Et})_3\text{N}$  with 0.75 mmol of  $\text{CH}_3\text{COSH}$  in MC solvent. The triethylammonium thioacetate solution was added in drops to Indium thioacetate, and stirred for over 2 h. After reaction, the solution was separated by extraction to get the organic layer, which was concentrated by rotary evaporation to get the resin. This resin was washed by petroleum ether and diethyl ether several times to obtain a light yellow powder, TEA-InTAA organometallic precursor.

In the  $^1\text{H-NMR}$  spectrum (Figure S1a), chemical shifts of protons in the ethyl groups of amine were at 1.36 ppm (9H,  $\text{CH}_3\text{CH}_2^-$ ) and 3.30 ppm (6H,  $\text{CH}_3\text{CH}_2^-$ ). The 12 protons of the thioacetate ligands ( $\text{CH}_3\text{C}(=\text{O})\text{S}$ ) peaked at 2.40 ppm.

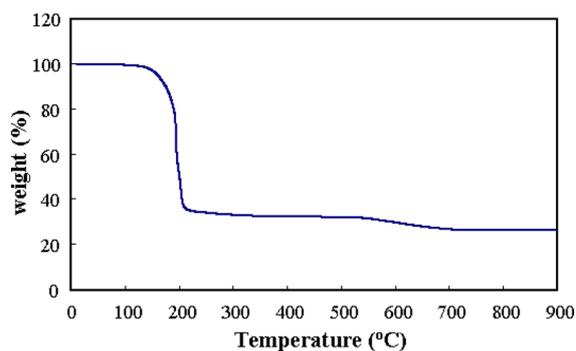


**Scheme S1.** Synthesis of the organometallic precursor,  $[(\text{Et})_3\text{NH}]^+ [\text{In}(\text{SCOCH}_3)_4]^-$  (TEA-InTAA).

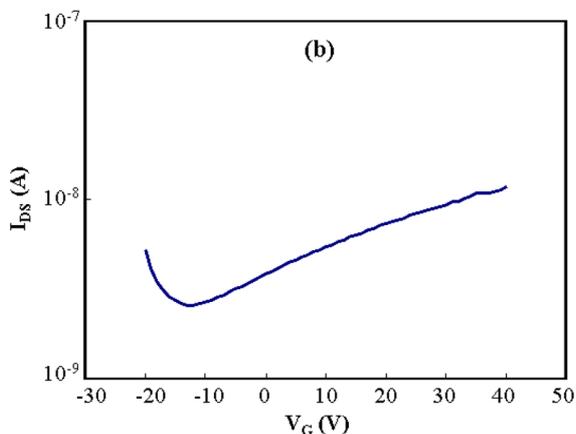
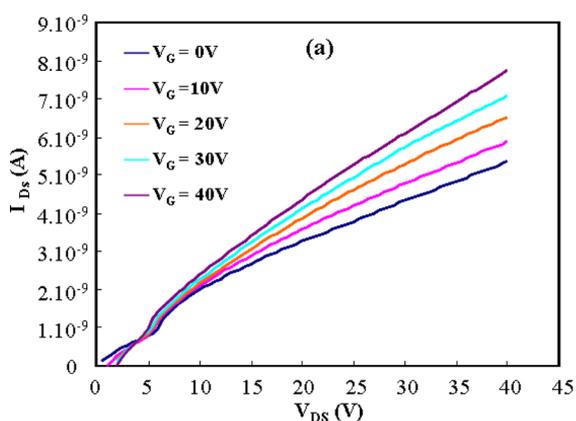


**Figure S1.** (a)  $^1\text{H-NMR}$  and (b)  $^{13}\text{C-NMR}$  spectra of the  $[(\text{Et})_3\text{NH}]^+ [\text{In}(\text{SCOCH}_3)_4]^-$  organometallic compound in  $\text{CD}_2\text{Cl}_2$  solvent.

Ethyl groups in the triethylammonium cation and thioacetate ligands were also responsible for peaks at 9.8 ppm ( $\text{CH}_3\text{CH}_2^-$ ), 48 ppm ( $\text{CH}_3\text{CH}_2^-$ ) and 34.5 ppm ( $\text{CH}_3\text{COS}$ ) in the  $^{13}\text{C-NMR}$  spectrum, Figure S1b. The clearly visible peak with a chemical shift of 206.5 ppm is due to the carbonyl group in the  $\text{CH}_3\text{C}(=\text{O})\text{S}$ .<sup>1</sup> The above assignments for protons and carbons are also sketched in Figure S1.



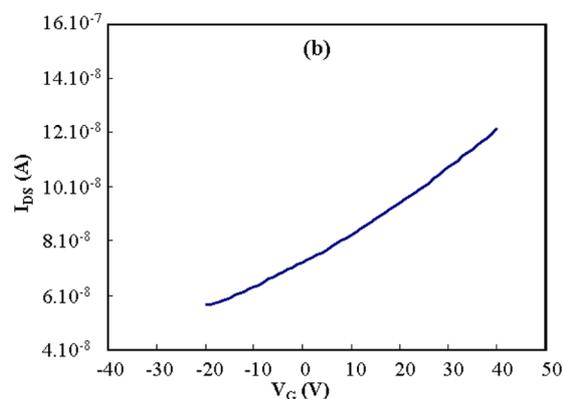
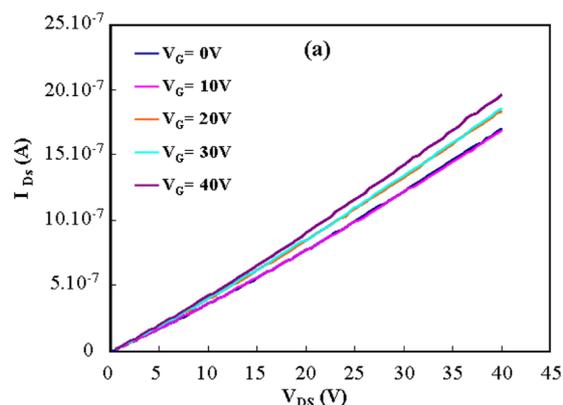
**Figure S2.** Thermogravimetric (TG) analysis graphs of the TEA-InTAA organometallic precursor. The samples were heated at a rate of 10 °C/min from room temperature to 900 °C, under a nitrogen atmosphere.



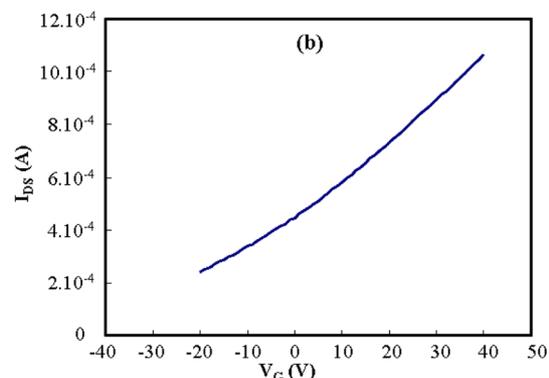
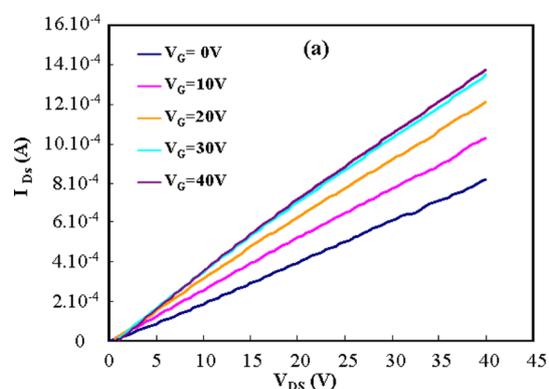
**Figure S3.** TFT properties of TEA-InTAA thin film cured at 300°C. (a) Output characteristics:  $I_{DS}$  versus  $V_{DS}$  for various  $V_{GS}$ . (b) Transfer characteristics:  $I_{DS}$  versus  $V_{GS}$  for constant  $V_{DS}$  ( $V_{DS} = 40$  V).

### Reference

- Deivaraj, T. C.; Lin, M.; Loh, K. P.; Yeadon, M.; Vittal, J. J. *J. Mater. Chem.* **2003**, *13*, 1149.



**Figure S4.** TFT properties of TEA-InTAA thin film cured at 400 °C. (a) Output characteristics:  $I_{DS}$  versus  $V_{DS}$  for various  $V_{GS}$ . (b) Transfer characteristics:  $I_{DS}$  versus  $V_{GS}$  for constant  $V_{DS}$  ( $V_{DS} = 40$  V).



**Figure S5.** TFT properties of TEA-InTAA thin film cured at 600 °C. (a) Output characteristics:  $I_{DS}$  versus  $V_{DS}$  for various  $V_{GS}$ . (b) Transfer characteristics:  $I_{DS}$  versus  $V_{GS}$  for constant  $V_{DS}$  ( $V_{DS} = 40$  V).