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ADVANCED MATERIALS INTERFACES

# Supporting Information

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# Transparent SnO–$SnO_2$ p–n Junction Diodes for Electronic and Sensing Applications

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# Supporting Information

**Transparent SnO-$SnO_2$ p-n Junction Diodes for Electronic and Sensing Applications**

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**Table S1**. Summary of p-mobility of SnO thin films.

| Structure [a)] | Method [b)] | Substrate[c)] | $T_{dep}$ [d)] [°C] | $T_{PDA}$ [d)] [°C] | $\mu_{Hall}$ [$cm^2 V^{-1} s^{-1}$] | $N_h$ [$cm^{-3}$] | Year | Ref |
|---|---|---|---|---|---|---|---|---|
| ep-SnO (001) | PLD | YSZ (001) | 575 | 200 | 2.4 | $2.5\times10^{17}$ | 2009 | [1, 2] |
| nc-SnO | EBE | Si/$SiO_2$ | RT | - | 2.6 | $5.0\times10^{18}$ | 2010 | [3] |
| pc-SnO | TE | Si/$SiO_2$ | RT | 310 | 2.83 | $5.0\times10^{17}$ | 2010 | [4] |
| pc-SnO | EBE | $SiO_2$ | RT | 600 | 1.4 | $2.8\times10^{16}$ | 2010 | [5] |
| pc-SnO | EBE | Si/$SiO_2$ | RT | 400 | 1.6 | $1.0\times10^{18}$ | 2010 | [6] |
| pc-SnO | RFMS | Glass | RT | 200 | 4.8 | $10^{16}$~$10^{18}$ | 2010 | [7, 8] |
| pc-SnO | RFMS | Si | RT | 300 | 0.6 | 2~$9\times10^{17}$ | 2010 | [9] |
| ep-SnO (001) | PLD | YSZ(001) | 550 | - | 2.4 | $2.5\times10^{17}$ | 2010 | [10] |
| pc-SnO | PLD | Si/$SiO_2$ | RT | 250 | 1.9 | $1\times10^{17}$ | 2011 | [11] |
| pc-SnO | RFMS | $SiO_2$ | 60 | - | 0.5 | $1\times10^{19}$ | 2011 | [12] |
| pc-SnO | RFMS | BS-Glass | 300 | - | 1.2 | $2.6\times10^{17}$ | 2012 | [13] |
| pc-SnO | EBE | Si/$SiO_2$ | RT | 350 | 3.9 | $5.6\times10^{15}$ | 2012 | [14] |
| pc-SnO | RFMS | BS-Glass | 300 | - | 1.7 | $1.4\times10^{17}$ | 2012 | [15] |
| pc-SnO | RFMS | $SiO_2$ | RT | 200 | 1.3 | $6.0\times10^{18}$ | 2012 | [16] |
| pc-SnO | RFMS | Glass | RT | 300 | 1.2 | $1.2\times10^{17}$ | 2013 | [17] |
| pc-SnO | DCMS | Si/$SiO_2$ | RT | 180 | 18.7 | $2.18\times10^{17}$ | 2013 | [18] |
| pc-SnO | RFMS | Si/$SiO_2$ | RT | 250 | 3 | $1.0\times10^{18}$ | 2013 | [19] |
| pc-SnO | RFMS | Glass | RT | 500 | 0.64 | $4.3\times10^{17}$ | 2013 | [20] |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SnO | PLD | YSZ(001) | 575 | - | 7 | $1\times10^{17}$ | 2013 | [21] |
| nc-SnO | RFMS | BS-Glass | 100 | - | 0.02 | $1.47\times10^{19}$ | 2013 | [22] |
| ep-SnO (00l) | PLD | YSZ(001) | 200 | - | 2.3 | $1\times10^{17}$ | 2014 | [23] |
| nc-SnO | RFMS | Glass | 100 | 300 | 0.13 | $7.3\times10^{18}$ | 2014 | [24] |
| pc-SnO | RFMS | Glass | RT | 300 | 3 | $7.22\times10^{16}$ | 2014 | [25] |
| pc-SnO | PLD | Glass | RT | 300 | 1.8 | $1.0\times10^{19}$ | 2014 | [26] |
| pc-SnO | RFMS | $Si/SiO_2$ | RT | 200 | 1.4 | $7\times10^{17}$ | 2014 | [27] |
| pc-SnO | RFMS | $SiO_2$ | 200 | - | 3.34 | $2.3\times10^{18}$ | 2014 | [28] |
| pc-SnO | ALD | $Si/SiO_2$ | 210 | - | 2.9 | $3.4\times10^{17}$ | 2014 | [29] |
| pc-SnO | RFMS | Glass | RT | 265 | 0.78 | $4.28\times10^{17}$ | 2014 | [30] |
| pc-SnO (00l) | PLD | $Si/SiO_2$ | 500 | - | 2 | $9.0\times10^{16}$ | 2015 | [31] |
| pc-SnO | DCMS | Glass | RT | 200 | 5.27 | $1.9\times10^{17}$ | 2015 | This report |

The parameters were taken from best Hall mobility sample in these literature reports. Explanation for column content and abbreviations in respective column. [a)]Structure: crystal structure of SnO. (ep: epitaxial; nc: nanocrystalline; pc: polycrystalline.) [b)]Method: preparation method for SnO thin film. (ALD: atomic layer deposition; EBE: electron beam evaporation; PLD: pulsed laser deposition; RF(DC)MS: radio frequency (direct current) magnetron sputtering. TE: thermal evaporation;) [c)]Substrate: substrate used in Hall measurement. (BS-Glass: borosilicate glass; YSZ: yttria stabilized zirconia; $SiO_2$: quartz.) [d)]$T_{Dep}$ and $T_{PDA}$: Substrate temperature during deposition and post deposition annealing process. (RT: room temperature)

**Table S2.** Sputtering and post-deposition annealing conditions for p-SnO and n-$SnO_2$.

| Materials | Source | Sputtering conditions | | | Post-deposition annealing | |
|---|---|---|---|---|---|---|
| | | Power [W] | Pressure [mTorr] | Oxygen Partial Pressure [%] | Temperature [$^oC$] | Duration [hour] |
| p-SnO | Tin target | 20 | 1.8 | 9 | 200 | 1.5 |
| n-$SnO_2$ | Tin target | 50 | 4 | 50 | 400 | 2 |

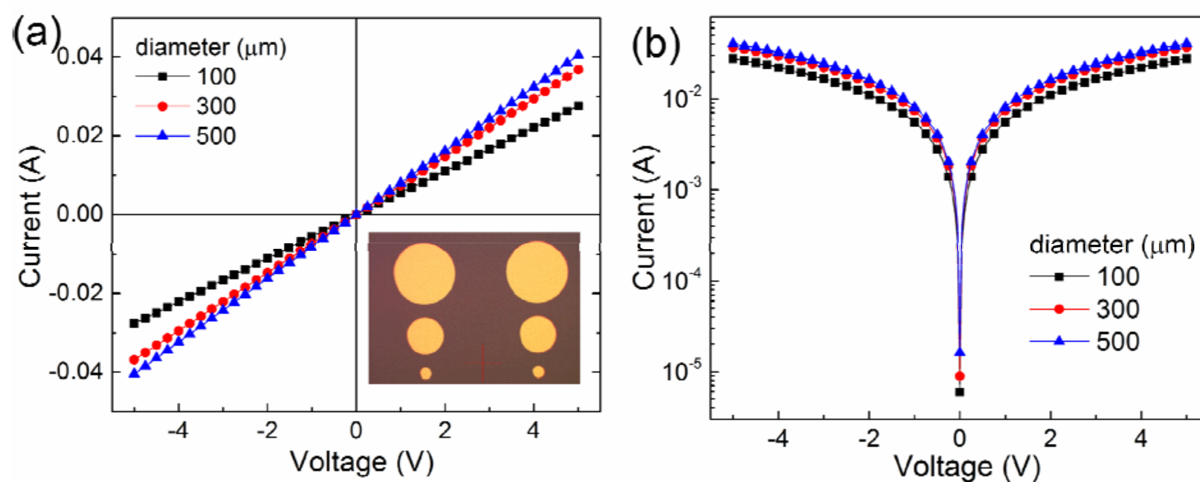


**Figure S1.** Current-voltage curve of Au/SnO/Au MIM structure in a) linear and b) log scale. Inset shows the image of actual devices.

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