Improved hole injection in p-$MoTe_2$ channel FET by O_2 plasma treatment

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MoO_3 has been employed in OLED research as a hole injection layer.[1,2] And with its deep work function, it enabled p-FET with MoS_2.[3]
Here, we induced MoO_x on the surface of a $MoTe_2$ nanosheet by O_2 plasma, which improves hole carrier injection between $MoTe_2$ channel and Pt electrode. Such improvement is demonstrated through p-$MoTe_2$ channel FET. With O_2 plasma treatment on the S/D area of $MoTe_2$ area, the field effect mobility of p-FET got about 2.5 times bigger.
Furthermore, a transparent p-FET with a $MoTe_2$ channel is fabricated for the first time.[4] Both O_2-plasma-induced MoO_x and ultrathin Pt layer between MoTe2 and S/D ITO electrodes enhance ON/OFF ratio and the mobility in a p-FET with ITO transparent electrodes.

References

[1] Ma J. W. et al, *Solid State Communications,* ***5-9*** (2009) 214-217
[2] de Castro, I. A. *et al, Adv. Mater.* ***29*** (2017) 1–31
[3] Chuang S. et al, *Nano Lett.*, ***14 (3)*** (2014) 1337–1342
[4] Kim, T. Y. *et al, ACS Nano*, **11** (2017) 10273–10280

Figures

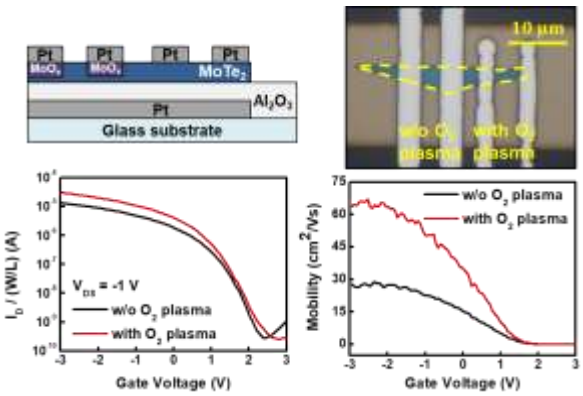

Figure 1: Two FET is fabricated with a single flake; with and without O_2 plasma treatment. Schematic cross section and OM image of the device are shown. (top) The performance improvement in FET is shown as I_{DS}-V_{GS} transfer characteristics and field-effect mobility. (bottom)

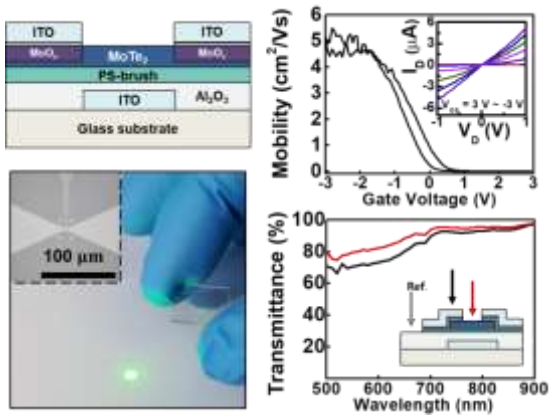

Figure 2: Schematic cross section of the transparent p-$MoTe_2$ channel p-FET with MoO_x/ultrathin Pt/ ITO for S/D (top left). Linear mobility plot and inset output characteristic curve (top right). Snapshot photo and inset optical microscope image of the transparent device on glass (bottom left). Transmittance characteristics of the transistor (bottom right)