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 MoTe$_2$ and S/D ITO electrodes enhance ON/OFF ratio and the mobility in a p-FET with ITO transparent electrodes.

References


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)