Flexible Active-Matrix Organic-Light Emitting Diode Display Enabled by High Performance MoS_2 Transistors for Wearable Electronics

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Abstract

Recently, there has been an increasing demand for electronic devices which has ultra-thin thickness, wide area, irregular surface wrapping, and easy attachment to human body for the implementation of intelligent electronic systems. [1, 2]. Transition-metal dichalcogenides (TMDs) such as molybdenum disulfide (MoS_2) at two-dimensional (2D) atomic scale have been realized much superior as compared to conventional materials due to their exceptional dominant combination of semiconducting and mechanical properties.

However, atomically thin MoS_2 which performs extensive research on semiconductor electronic devices has not yet been studied in real active matrix driven large organic light emitting diode (OLED) displays. The biggest obstacle that restricts its applicability as drive element is to impart a large contact resistance at metal/MoS_2 interface and hindered carrier transport at conventional SiO_2 dielectric surface which greatly deteriorate the mobility [3].

In this study, we propose the modified switching device architecture to efficiently utilize the high-k Al_2O_3 layer that can drive an ultra-thin OLED display even under dynamic folding when integrated into the active matrix system. The modified structure in combination of Al_2O_3 layer showed 28 times increment in mobility over normal back gated TFT and is readily adapted for demonstrating the operation of display while attached to human wrist with 6×6 pixel array.

References

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