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Supporting Information for

Synthesis, Characterization and Fabrication of Ultrathin Iron Pyrite (FeS_2) Thin Films and Field-effect Transistors

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I. Calculation of the Device Parameters

Table 2 in the main text lists a few device parameters that were calculated. The capacitance of oxide is calculated from $C_{ox} = (\varepsilon_{SiO_2}\varepsilon_0)/T_{ox}$.

The on and off current is the average current of the corresponding region in the Ids vs. Vds plot. The I_{on}/I_{off} ratio is simply the ratio of the on and off current, and the On-state resistance is the average resistance from the on state region.

The mobility is determined from the following equation:

$I_D = \mu C_{ox}\frac{W}{L}(V_{GS} - V_T)V_{DS}, for\ |V_{DS}| \ll (V_{GS} - V_T)$, which is the standard equation used to calculate the MOSFET biased with a small drain-to-source voltage in the linear region.

Resistivity (ρ) is based on the device diameter and the resistance at Vg=0 V. In our case, the FeS_2 thin film is highly doped, and the carrier concentration of the device can be calculated from $n = \frac{1}{q\mu\rho}$.

II. Structure characterization and optical properties of FeS_2 thin film on quartz substrate

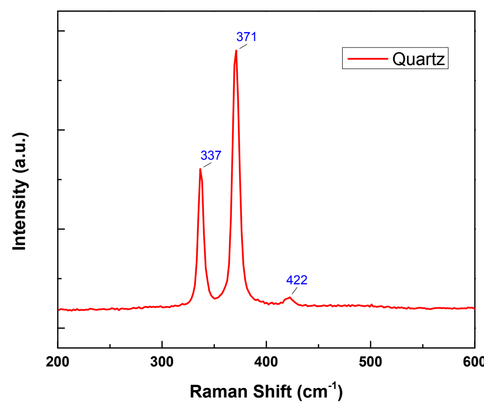

Figure S1. Raman spectrum of FeS_2 thin film on quartz.

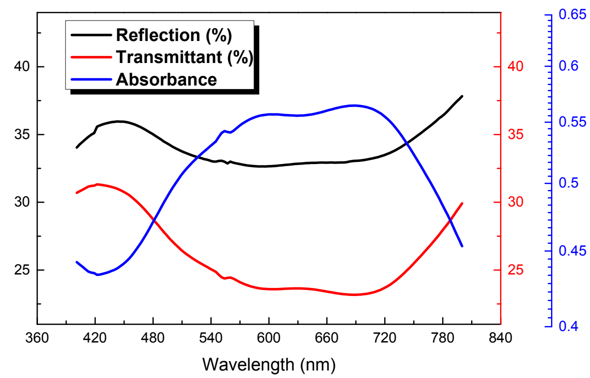

Figure S2. Optical properties of FeS_2 thin film on quartz.

The optical measurement is conducted by a Lambda 20 (Perkin Elmer) UV/VIS Spectrophotometer. The result is a direct measurement of the sample with the substrate. Hence the reflection and transmittant of the substrate is not remove.