Supporting Information

Large Area Vertically Oriented Few-Layer MoS_2 for Efficient Thermal Conduction and Optoelectronic Applications

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S1- AFM Study:

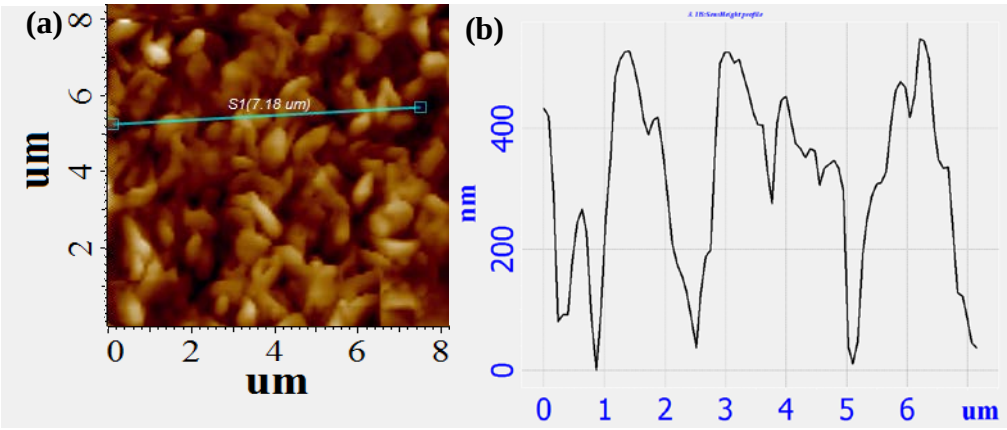

Figure S1. (a) AFM image of VFL-MoS_2 in 2D view. (b) Height profile for VFL-MoS_2.

AFM image indicates uniform growth of vertically oriented MoS_2 over Si. The height profile of the vertically grown MoS_2 sample shows the MoS_2 nanoflakes height around 500 nm in the perpendicular direction to the substrate i.e. vertical direction.

S2- Schematic of optothermal Raman technique

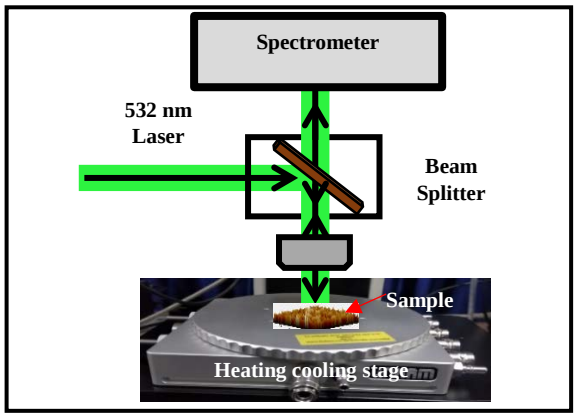

Figure S2. Schematic of optothermal Raman technique

Thermal conductivity of VFL-MoS_2 nanoflakes was investigated using optothermal Raman technique, as shown schematically in Figure S2.

S3- Temperature dependent Study

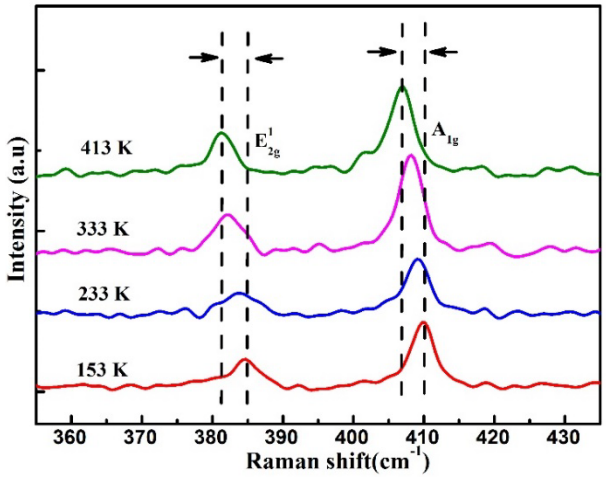

Figure S3. Temperature dependent Raman spectra of VFL-MoS_2 at different temperatures

A redshift is observed for both in-plane vibration E^1_{2g} and out-off-plane vibration A_{1g} modes with the increase in temperature.

S4- Schematic of heat conduction process

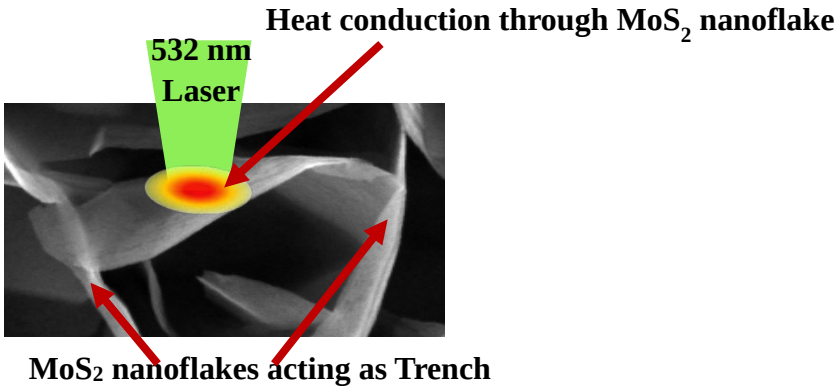

Figure S4. Schematic of heat conduction process in VFL-MoS_2.

The vertically oriented few-layer MoS_2 behaves like suspended flakes between other two flakes acting as trench for heat sink. The laser spot size is comparable to the lateral dimension of grown MoS_2.