

## Supplementary materials

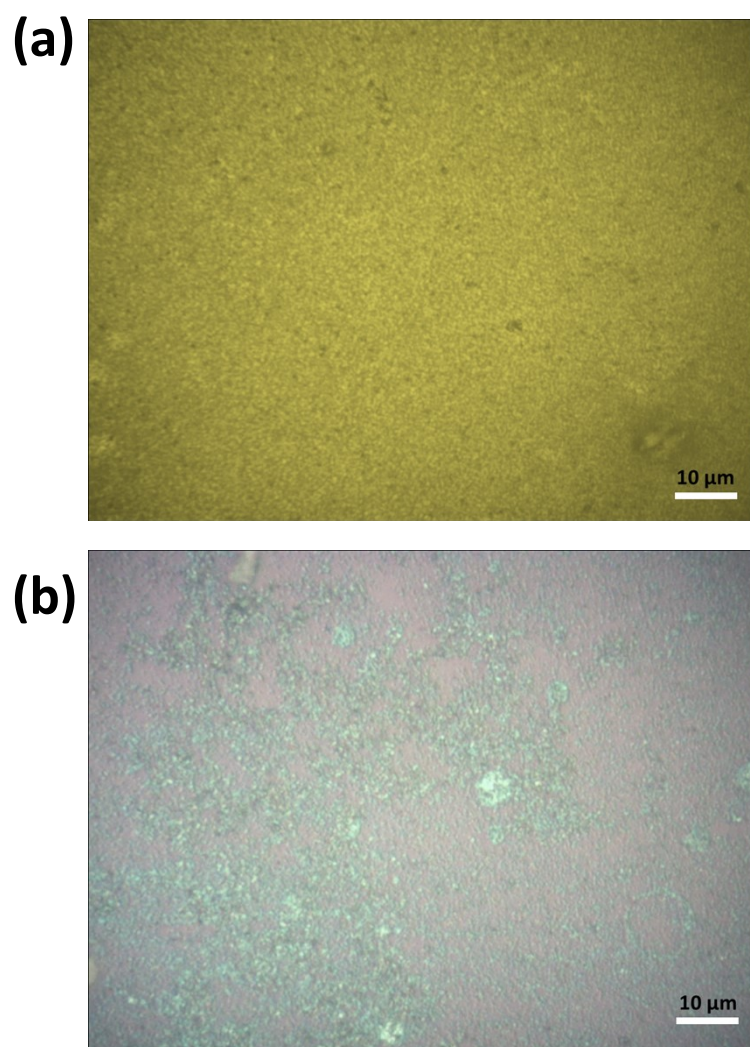
### The Growth Mechanism and Intriguing Optical and Electronic Properties of Few Layered HfS<sub>2</sub>

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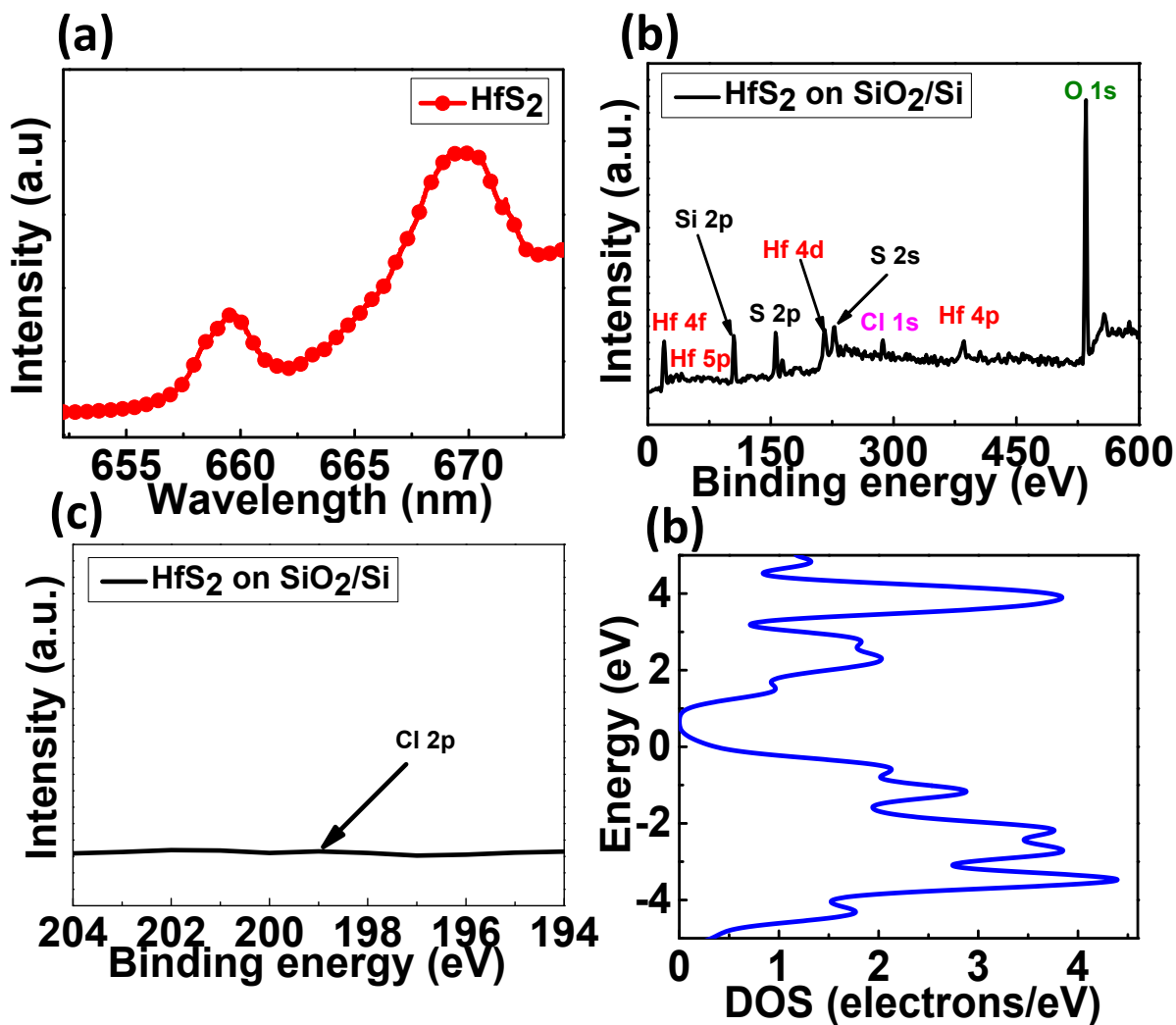
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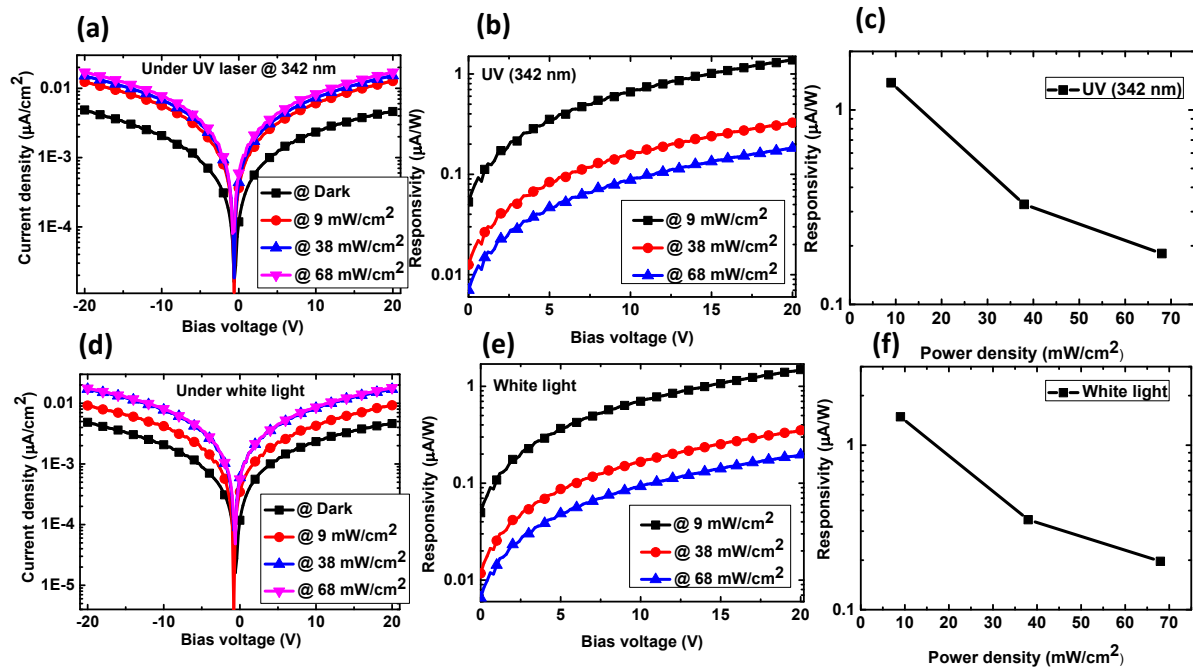
**Email:** mltsai@mail.ntust.edu.tw



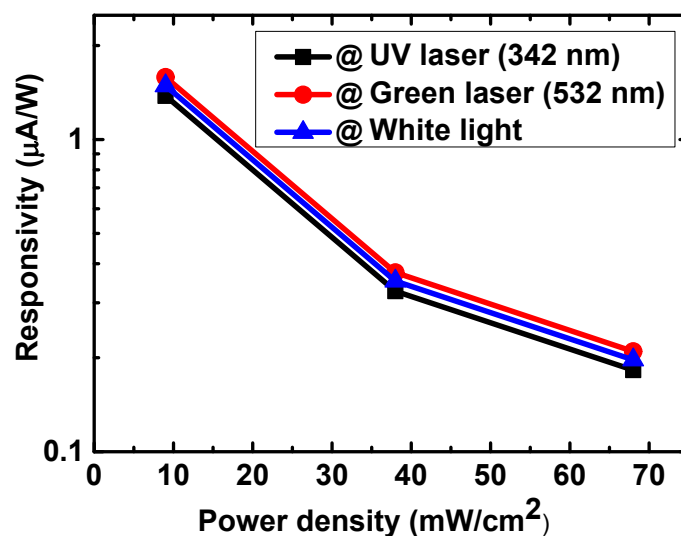
**Figure S1:** The optical images of as grown few layered  $\text{HfS}_2$  **(a)** onto c-plane sapphire **(b)**  $\text{SiO}_2/\text{Si}$  substrates, respectively.



**Figure S2:** (a) Photoluminescence (PL) spectra of as grown HfS<sub>2</sub> onto SiO<sub>2</sub>/Si. (b) The XPS spectra of as grown few layered HfS<sub>2</sub> on SiO<sub>2</sub>/Si substrate (c) Zoom spectra to check entire suppression of Cl elements. (d) The calculated density of states of the HfS<sub>2</sub>.



**Figure S3:** (a) Current-voltage ( $I$ - $V$ ) characteristics of fabricated  $\text{HFS}_2$  photodetector on  $c$ -plane sapphire under dark and under UV laser light illuminations at different laser power intensities. (b) The responsivity vs bias voltage curve of the photodetector at different laser intensities. (c) The responsivity curve as a function of power densities at applying bias voltage of 20 V. (d) The  $I$ - $V$  characteristics of the photodetector under dark and under white light illuminations at different laser power intensities. (e) The responsivity vs bias voltage curve of at different laser intensities. (c) The responsivity curve as a function of power densities at applying bias voltage of 20 V.



**Figure S4:** The comparison of obtained responsivity under UV, green, and white light illuminations as function of power density at an applied bias voltage of 20 V.