Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Excellent response to near ultraviolet light and large intervalley scatterings of electrons in 2D SnS_2

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I. CHARACTERIZATION OF AS-SYNTHESIZED SNS_2 FILMS

A series of SnS_2 films (S1-S4) were prepared with different thickness. When the sample is thin, good uniformity can be maintained. Fig. S1(a) shows the Atomic force microscopy (AFM) image of sample S1, the surface of the film is relatively smooth, and the root mean square roughness is 0.58 nm. Raman spectra of the investigated SnS_2 films are presented in Fig. S1(b). X-ray photoelectron spectroscopy (XPS) was used to examine the chemical state of the as-grown SnS_2 samples shown in Fig. S1(c). X-ray diffraction (XRD) pattern of as-grown samples are shown in Fig. S1(d). Fig. S1(e) shows the height profile of ultrathin SnS_2 nanosheet along the auxiliary line in inset (corresponding typical AFM image).

II. BAND STRUCTURE AND PHONON DISPERSION

The electronic bands and phonon dispersion are shown in Fig. S2. The little groups of each high symmetry point and line are presented on the top of each pictures. Corresponding irreducible representations of each phonon mode are indicated as well.

III. SELECTION RULE FOR ELECTRON-PHONON COUPLINGS

Based on the group theory, the scattering channels for electron-phonon couplings in Brillouin zone are shown in Fig. S3 for both electrons and holes.

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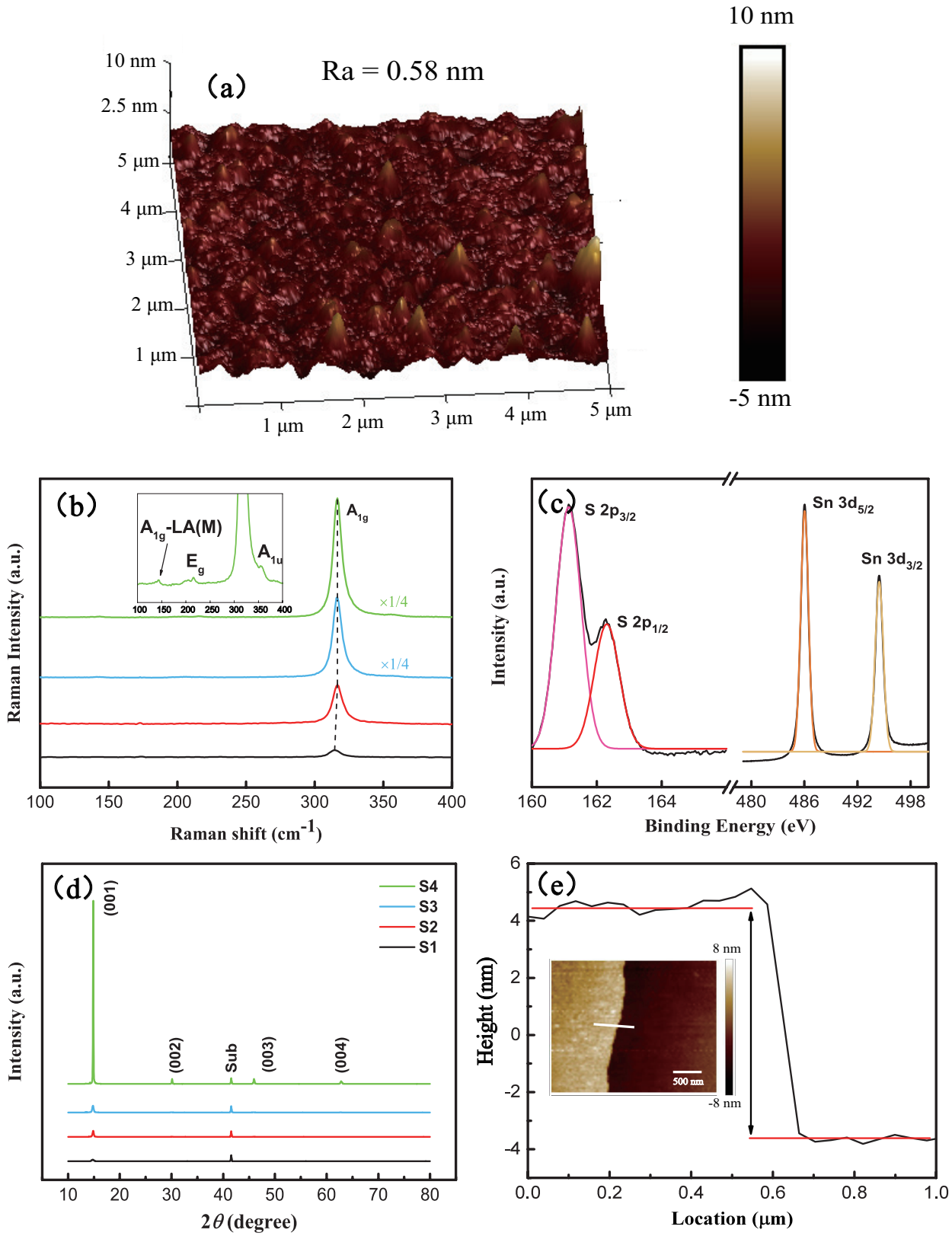

FIG. S1: (a) AFM image of S1 sample (b) Room temperature Raman spectra of SnS_2 films with 532 nm excitation laser. (c) XPS spectrun showing binding states of S 2p and Sn 3d. (d) XRD patterns of the SnS_2 films and sapphire substrates. (e) The height profile of ultrathin SnS_2 corresponding typical AFM image.

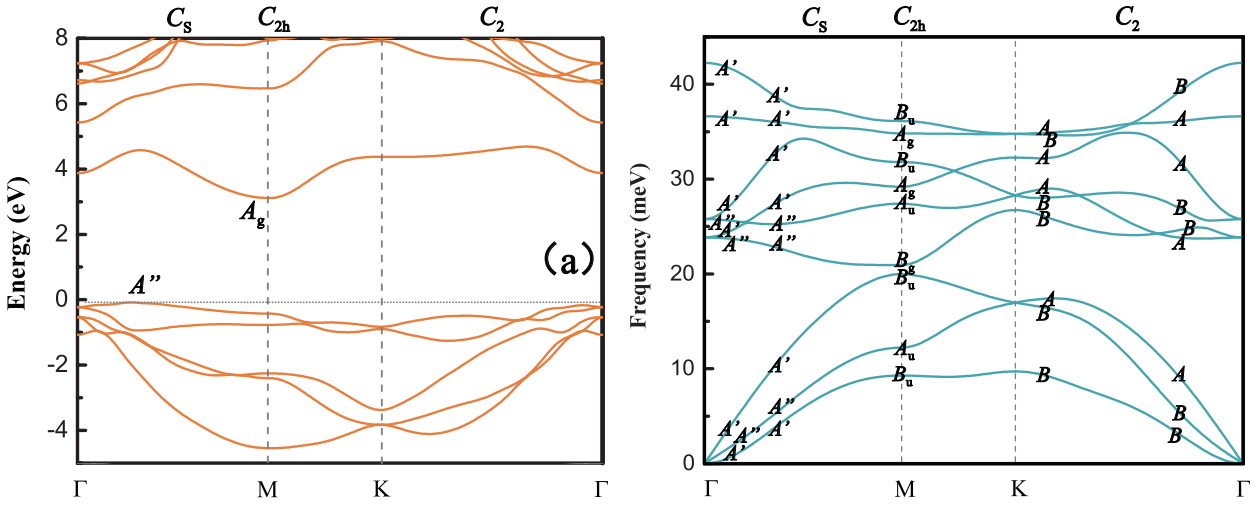

FIG. S2: The electronic band structure and phonon dispersion relation of SnS_2.

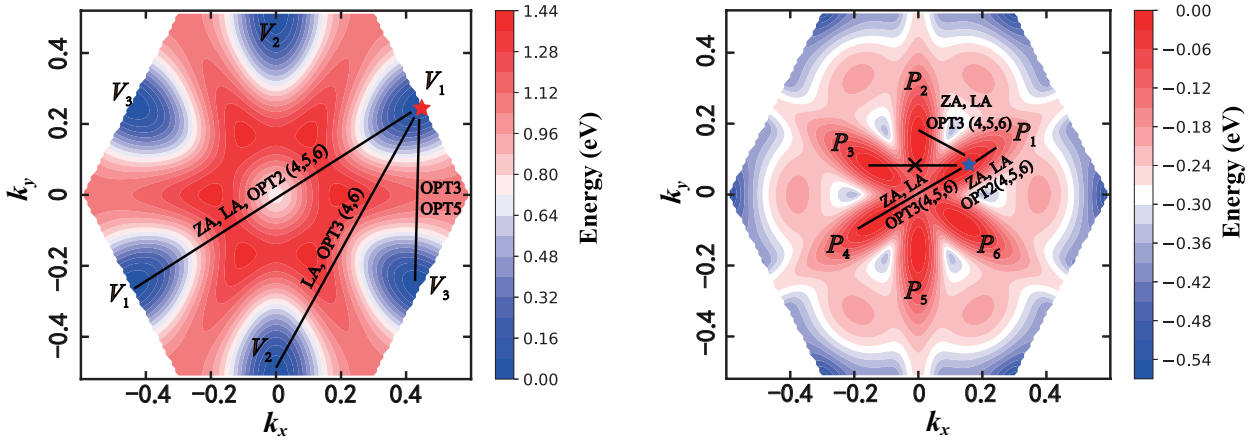

FIG. S3: The transitional K-path of intravalley(peak) and intervalley(peak) scattering for the CBM electrons and VBM holes obtained by group theory.