Electronic supplementary information

Heterovalent substitution in anionic and cationic positions of PbS thin-films grown by SILAR method vis-à-vis Fermi energy measured through scanning tunneling spectroscopy

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Fig. S1 AFM images of scratched SILAR films (10 layers each) along with the depth profile of the scratch.
Fig. S2 (a) Full-range XPS spectrum of Cl@PbS. High-resolution spectra of the material resolving binding energies of Pb4f, Pb4d, S2p and S2s and Cl2p and Cl2s electrons are shown in (b) through (e), in sequence.

Fig. S3 SEM image of a pristine PbS thin film.
**Fig. S4** Schematic band diagram of Ag@PbS having a dopant content of 1-6 atomic% with respect to lead. The atomic% of silver is shown as legends. Band positions of pristine PbS are also presented in the figure. The dashed line represents each semiconductor’s Fermi energy, which was aligned to 0 V.

**Fig. S5** Schematic band diagram of halide-doped PbS thin-films. Band positions of pristine PbS are also shown in the figure. The dashed line represents each semiconductor’s Fermi energy, which was aligned to 0 V.