Layered Ternary Sulfide CuSbS$_2$ Nanoplates for Flexible Solid-State Supercapacitors

Karthik Ramasamy,¹* Ram. K. Gupta,² Hunter Sims,³ Soubantika Palchoudhury,⁴ Sergei Ivanov,¹ Arunava Gupta⁴*

¹Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Albuquerque, NM-87185
²Department of Chemistry, Pittsburg State University, Pittsburg, KS-66762.
³German Research School for Simulation Science, Jülich, Germany-52425
⁴Center for Materials for Information Technology, The University of Alabama, Tuscaloosa, AL-35487

Supporting Information
Figure S1. (a) XPS survey spectrum of CuSbS$_2$ nanoplates. (b)-(d) High resolution XPS spectra of Cu, Sb and S, respectively.
Figure S2. (a) and (b) Top and side view HRTEM images of a CuSbS$_2$ nanoplate. (c) and (d) Fast Fourier transform (FFT) of HRTEM images shown in (a) and (b). (e) and (f) TEM images of 55 ± 6.5 nm and 105 ± 5.5 nm nanoplates.
Figure S3. Cyclic voltammogram curves of CuSbS$_2$ at various scan rates using KOH as electrolyte.
Figure S4. Plots of the anodic and cathodic wave current versus the square root of the scan rate.
Figure S5. SEM images of (a) 7.2 ± 1.4 nm and (b) 19 ± 1 nm thick CuSbS$_2$ nanoplates.
**Figure S6.** Intercalated K ion in van der Waals gap of CuSbS$_2$. The adsorbed ion has taken the place of its nearest Sb ion, which is pushed into the interior of the layer. Cu sites are blue, Sb are orange, and S are yellow.
Figure S7. (a) Cyclic voltammogram curves of CuSbS$_2$ nanoplates at different bending angles.
Figure S8. (a) Cyclic voltammogram curves of CuSbS$_2$ nanoplate supercapacitor device at different temperatures using LiOH. (b) A graph showing changes in specific capacitance with temperatures. Specific capacitance values are deduced from the CV curves. (c) Galvanostatic discharge characteristics of CuSbS$_2$ nanoplate device at different temperatures. (d) A graph showing change in specific capacitance with temperature. $C_{sp}$ was calculated from the galvonostatic charge-discharge measurements.