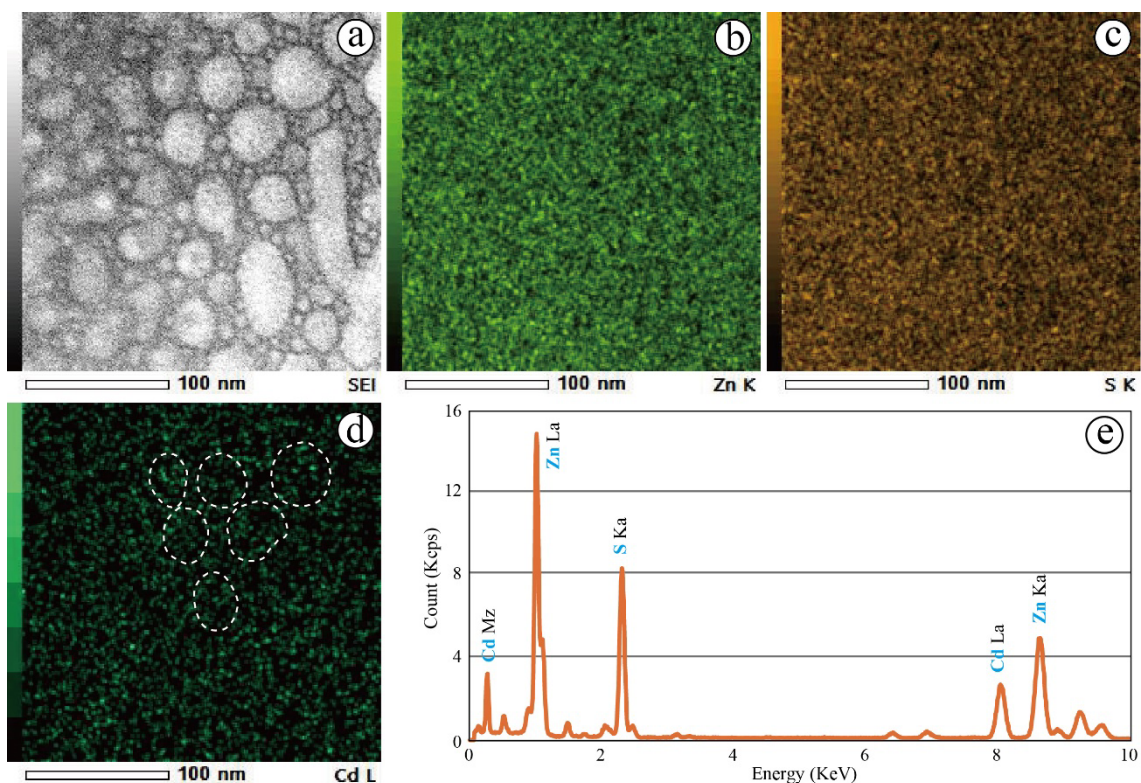


Supplement Figure 1. The sample preparation process for STEM. (a) Deposit a Pt protective layer at the selected position and create two pits to expose the sample area; (b) Weld the sample onto the manipulator, then cut off and extract the sample from the host mineral; (c) Transfer the sample and weld it onto the copper grid; (d) Thin the sample using Ga ion beam repeatedly until it becomes electron transparent (with a thickness less than 0.1 μm).



Supplement Figure 2. The energy-dispersive X-ray spectroscopy (EDS) mapping image and corresponding energy spectrum for the Cd-rich areas in sphalerite. (a) The secondary electron image (SEI) of the Cd-rich areas in sphalerite; (b-d) The EDS mapping images show the distribution of Zn, S, and Cd in the Cd-rich areas. Especially, the occurrence of localized enrichment of Cd within nanoscale protrusions in (d); (e) The energy spectrum of the Cd-rich areas.