Electronic Supplementary Information

S-hindered synthesis of PbSe/PbS nanosheets with enhanced electrochemical activities

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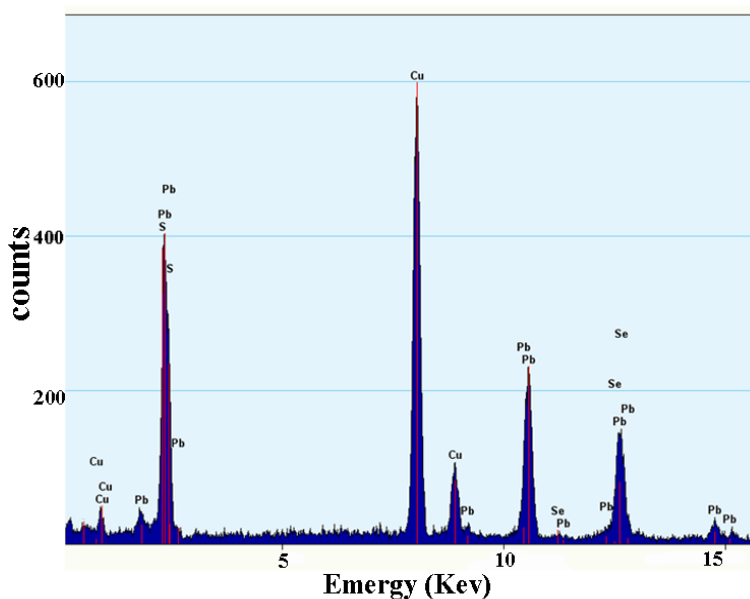

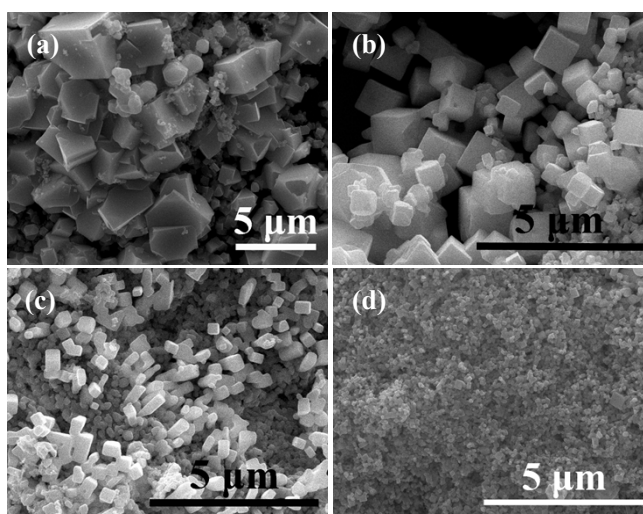Figure S1. The EDS spectrum of the PbSe/PbS nanosheets.

Figure S2. SEM images of samples prepared under similar conditions but with sulfur powder replaced by (a) L-cysteine, (b) thiourea, (c) thioacetamide and (d) Na_2S.
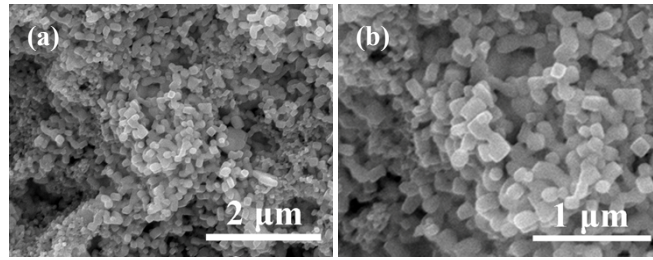
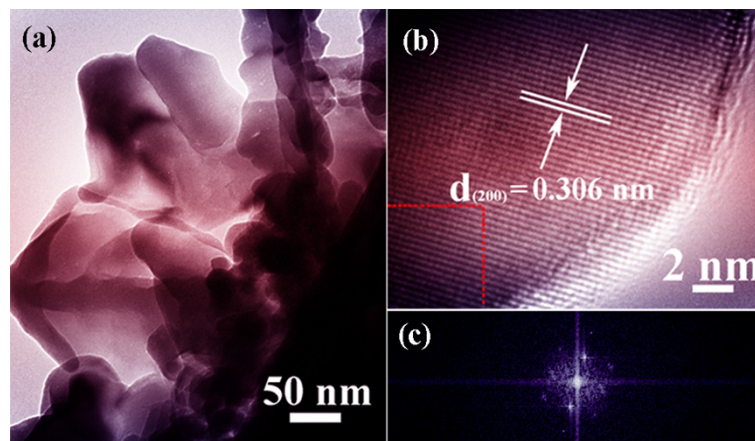Figure S3. SEM images of samples prepared under similar conditions but with adding 2 ml hydrazine hydrate.

Figure S4. Characterization of PbSe flower-like crystals obtained at 180 °C for 24 h in the presence of 0g sulfur powder: (a) TEM and (b) HRTEM image taken from the corner of a single sheet, (c) corresponding FFT patterns of HRTEM images from red square region.
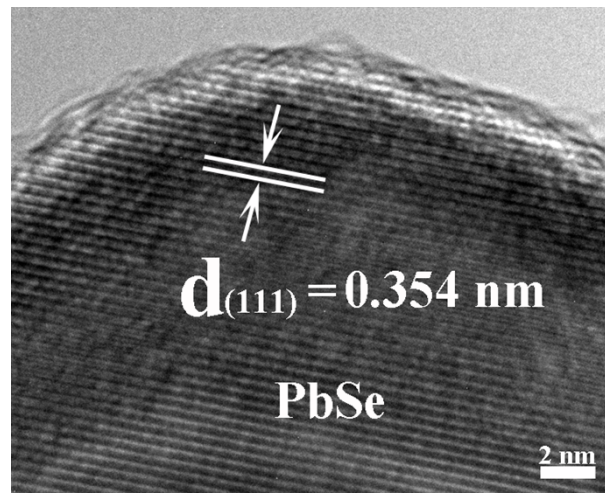

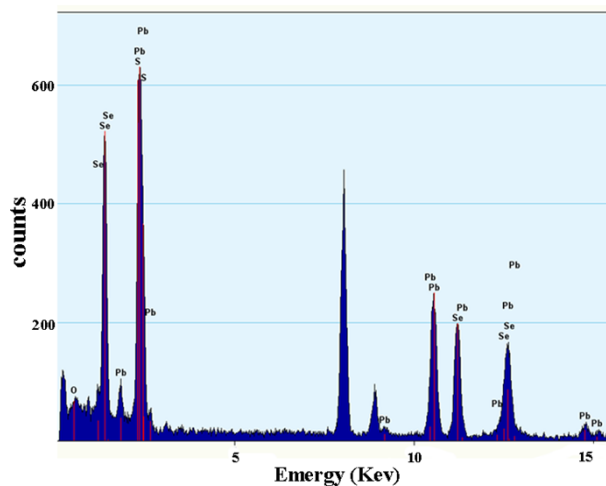Figure S5. The HRTEM images of free PbSe.

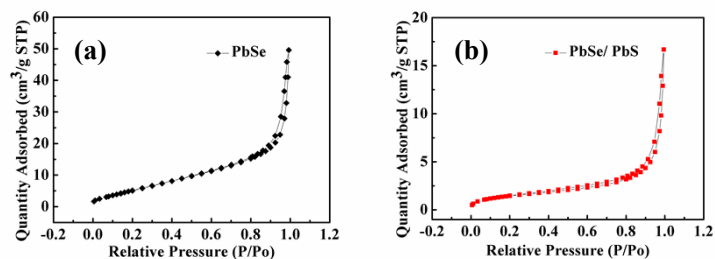Figure S6. The EDS spectrum of the samples (x_{PbS}= 0.4).

Figure S7. Typical nitrogen adsorption-desorption isotherm of the flower-microsphere PbSe (a) and nanosheet PbSe/PbS with GB (b).

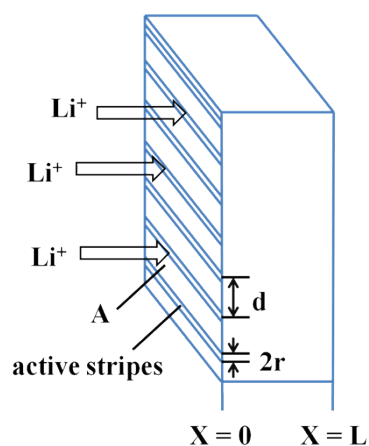**The expression for the effective diffusion coefficient**

Figure. S4 Schematic of master examples. Surface exchange takes place at active stripes.

Diffusion of Lithium-ion in a binary mixed conducting chalcogenides with electron and doubly charged ionic defects (ion)

The partial conductivities due to individual defects are denoted: σ_j (the subscript j stands for ion,

electron(eon))

charge number: z_j

diffusion coefficient: D

stoichiometry numbers associated with the reaction Li f Li$^+$ + e$^-$: v_j.

ambipolar conductivity: $\sigma^\delta \equiv \sigma_{ion}\sigma_{ion}/(\sigma_{ion} + \sigma_{ion})$

diffusion resistance: R^δ

In the linear regime $\Delta_\mu = \partial_\mu/\partial_c\,(c_{x=d} - c_{x=0})$

rate constant of local active sites: k_{local}

apparent surface rate constant: k_{app}

Recalling[1] that, $D^\delta = (ez_j\,v_j)^{-2}\sigma^\delta\partial_\mu/\partial_c$, subsurface layer of thickness d yielding the flux: $J_x = -4D^\delta$
$$\frac{r}{d^2}\,(c_{x=d} - c_{x=0})$$

The flux density through the active sites, scales with the flux density J_x^{local} at x = d with the

geometric factor contact area/total area = $\dfrac{\pi r^2}{d^2}$. In addition, if L $?$ d, $c_{x=d}$ can be replaced by $c_{x=0}$.

Taking this into account, above equation rewrites as

$$\frac{1}{k_{app}} \approx \frac{1}{4Dr/d^2} + \frac{1}{k_{local}\pi(r/d)^2}$$

In cases in which the local surface kinetics is very fast ($k_{local} \to \infty$), k_{app} simplifies to

$$k_{app} \approx 4Dr/d^2$$

1. C. Wagner and Prog. Solid State Chem., 1975, 10, 3.