Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Structural Evolution During Solution-Based Synthesis of $Li_7P_3S_{11}$ Solid Electrolyte by Synchrotron X-ray Total Scattering

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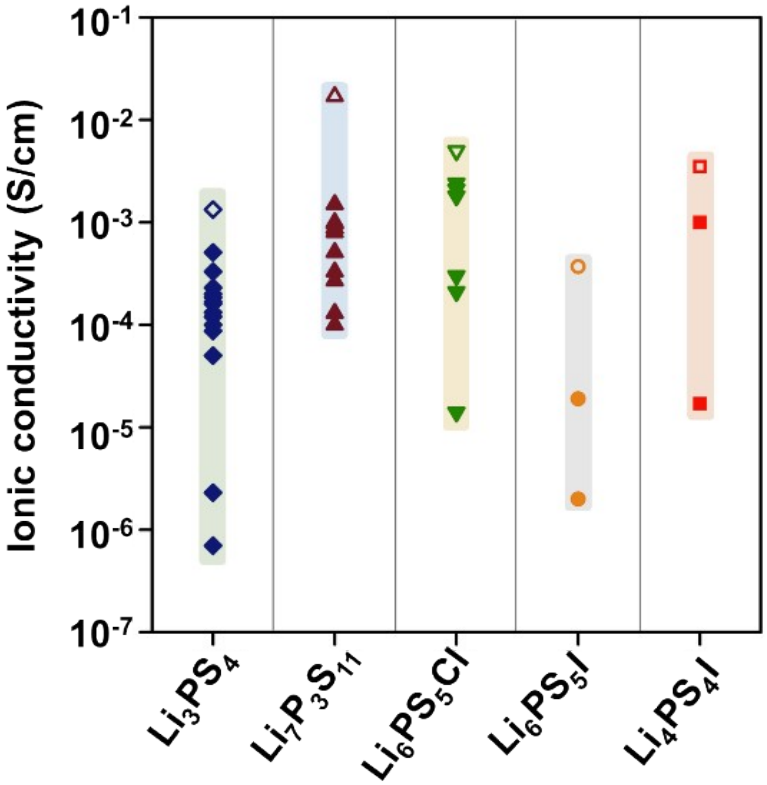

Figure S1. Ionic conductivities of SEs synthesized by solution method (solid symbols)[1–26] and by solid-state synthesis/ball-milling methods (hollow symbols).[27–29]

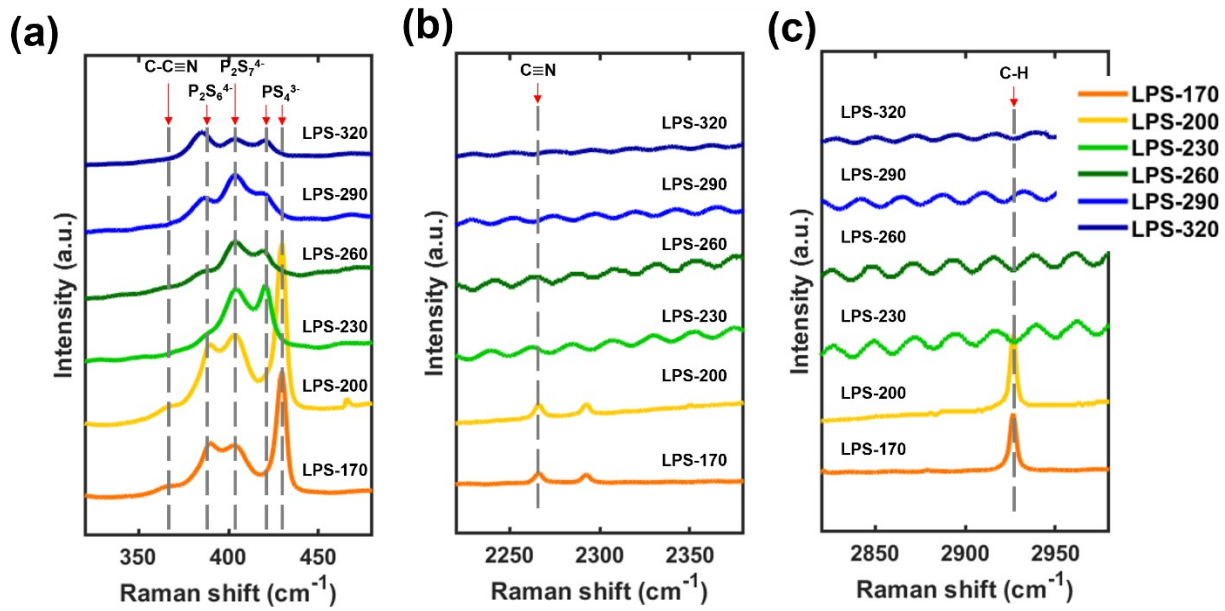

Figure S2. Raman spectra of SEs annealed from 170 ºC to 320 ºC in the range of 320-480 cm^{-1} (a) 2220-2380 cm^{-1} (b), and 2820-2980 cm^{-1} (c).

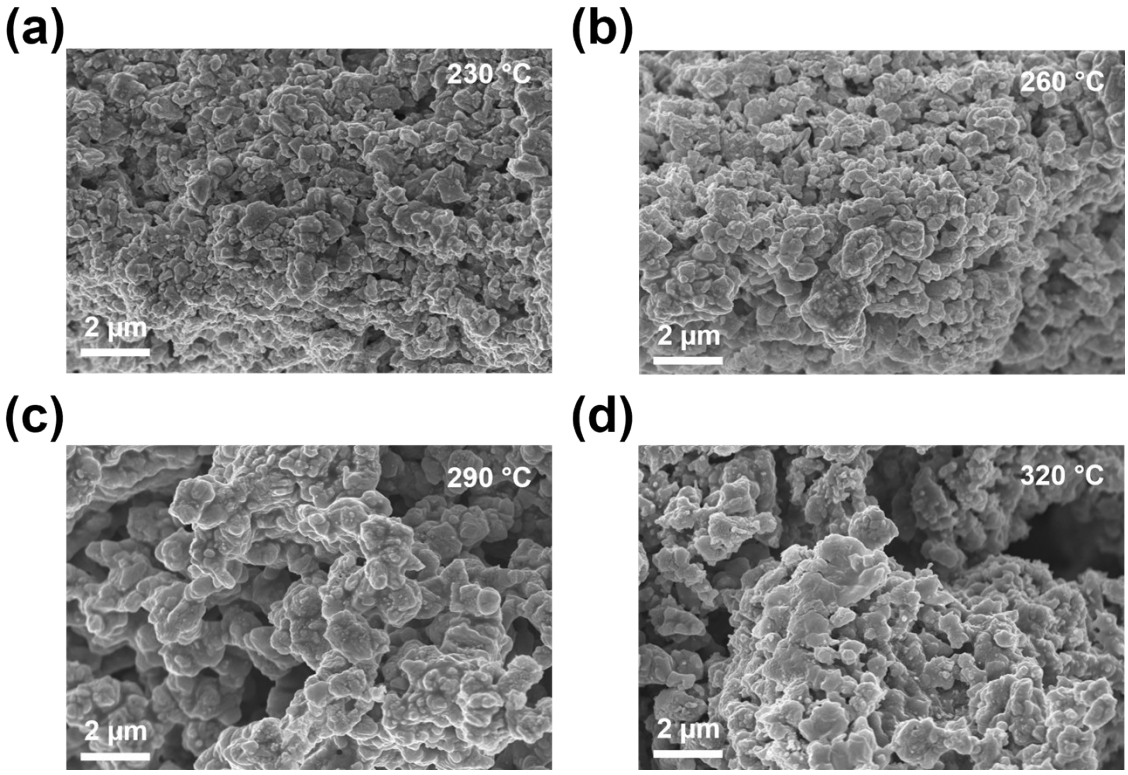

Figure S3. Particle morphology of SEs annealed at 230 ºC (a), 260 ºC (b), 290 ºC (c), and 320 ºC (d).

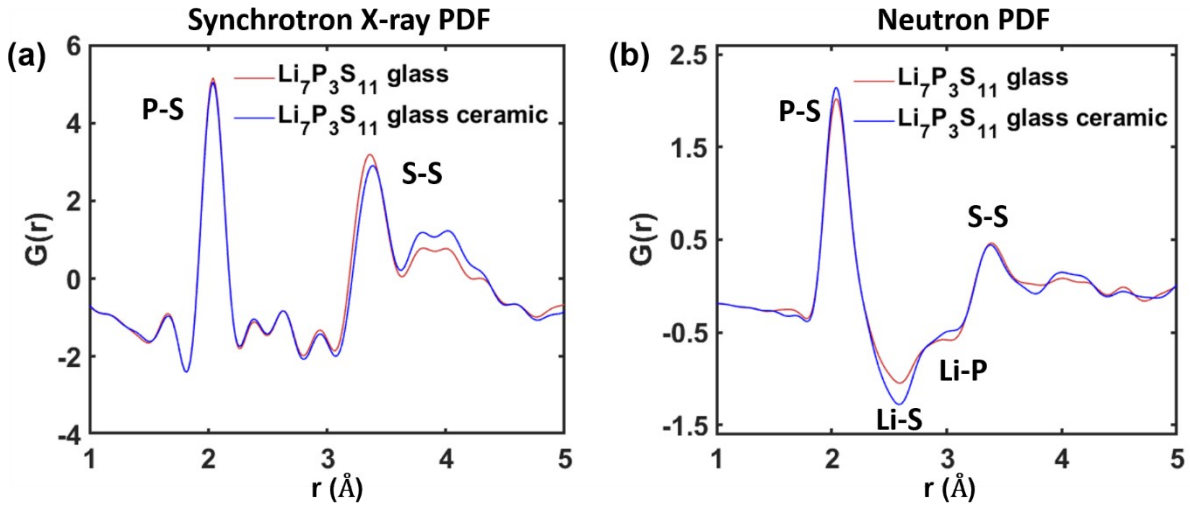

Figure S4. Synchrotron X-ray (a) and neutron (b) PDFs of $Li_7P_3S_{11}$ glass and glass ceramic synthesized by ball-milling method.

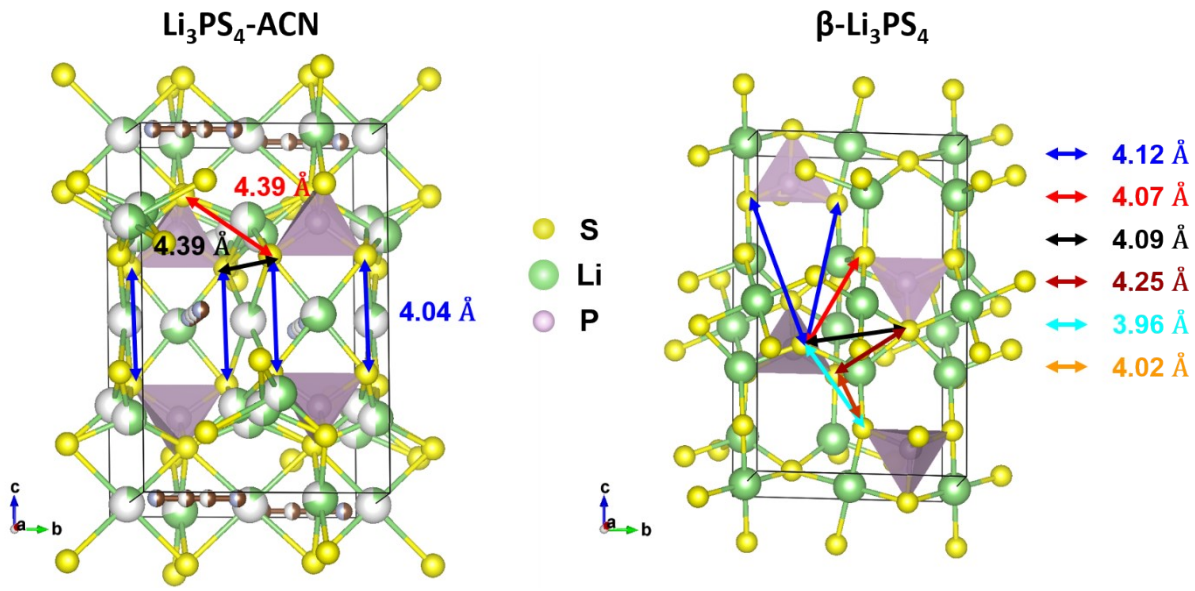

Figure S5. (a) Structure of Li_3PS_4-ACN complex and β-Li_3PS_4 with characteristic S-S bonds between adjacent PS_4^{4-} units. (b) Calculated reduced PDFs of Li_3PS_4-ACN complex and β-Li_3PS_4.

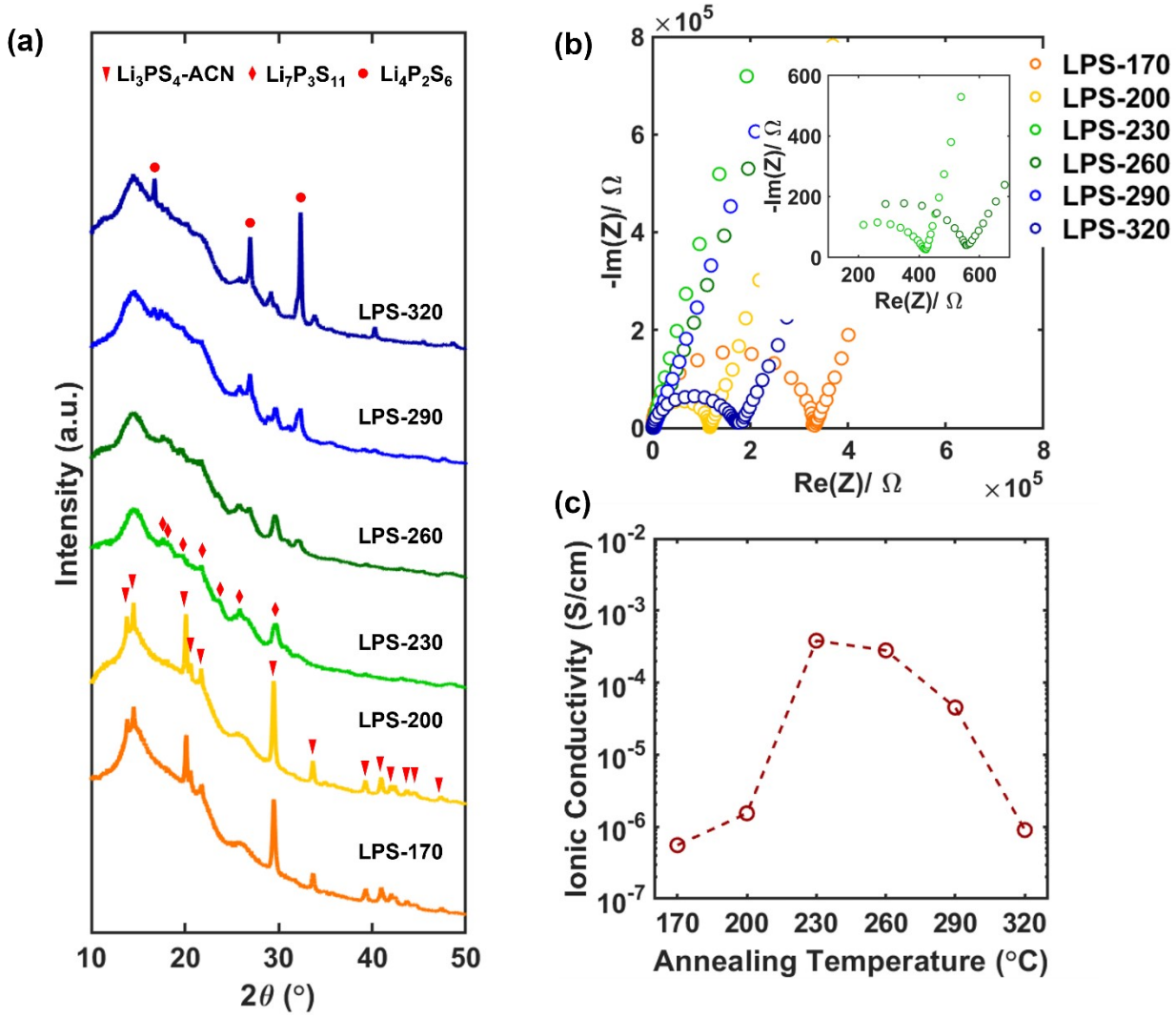

Figure S6. Structural and ionic conductivity measurement of SEs annealed at different temperatures for 6 hours. (a) Lab X-ray diffraction patterns of SEs synthesized after annealing at different temperatures for 6 hours. (b) Impedance plots of SEs with stainless steel blocking electrodes measured at room temperature. The impedance measurement was performed from 7 MHz to 10 mHz. (c) Room temperature ionic conductivity of SEs synthesized after annealing at different temperatures for 6 hours.

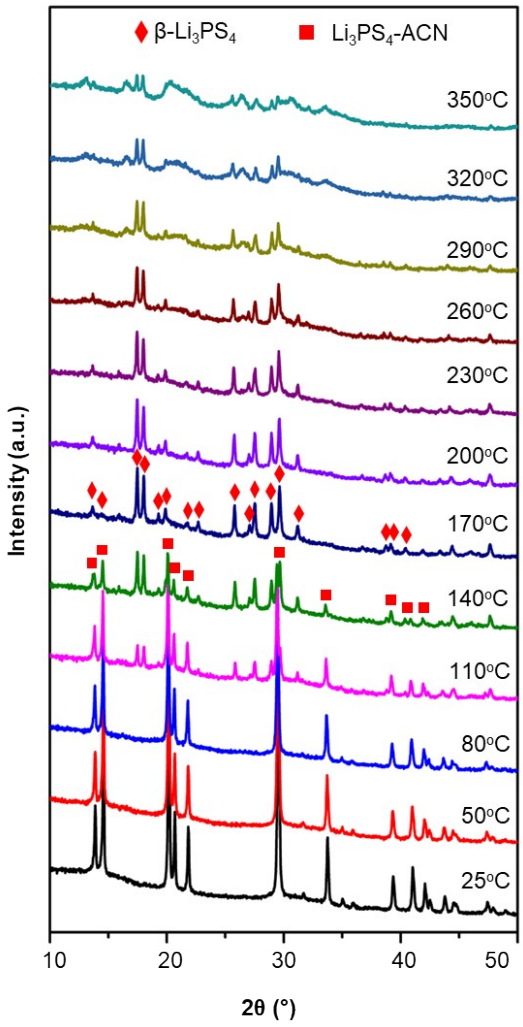

Figure S7. In-situ XRD patterns during vacuum annealing of solution-synthesized precursor for the synthesis of $Li_7P_3S_{11}$.

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