

## Electronic Supplementary Information

### Phase evolution during lithium-indium halide superionic conductor dehydration

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Figure S1 shows a higher quality XRD patterns of the starting material and end product of dehydration. The refined structure is presented in the main text, Figure 1. Figure S2 shows higher quality diffraction patterns during the phase transition found by XRD. The peaks here were fitted and the relative full-width-half-maximum changes are plotted in Figure S3. Fig. S3 shows that the hydrate phase does not broaden until phase transformation occurs. The anhydrous phase forms with broad peaks that narrow as the crystallinity increases. The peaks further sharpen after cooling down.

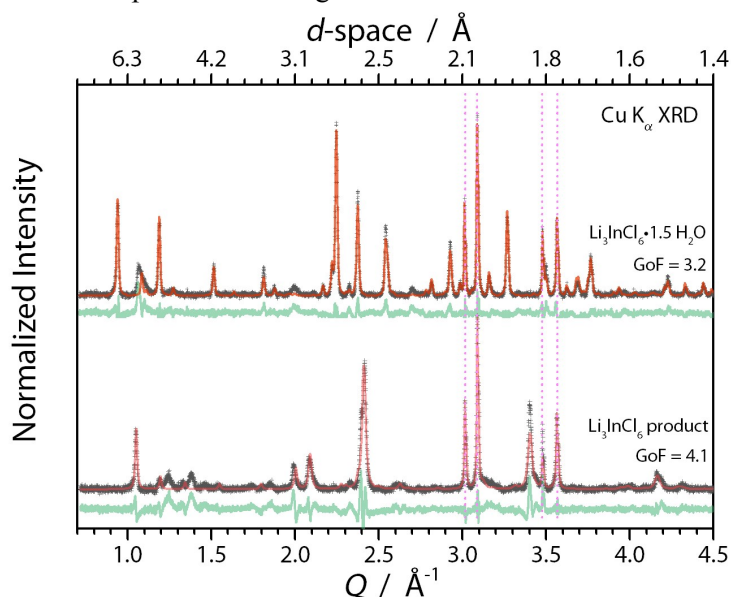


Figure S1: in situ X-ray diffraction patterns of  $\text{Li}_3\text{InCl}_6$  hydrate starting material and anhydrous end product. Red bars are from the Ni- and Cu-containing sample holder.

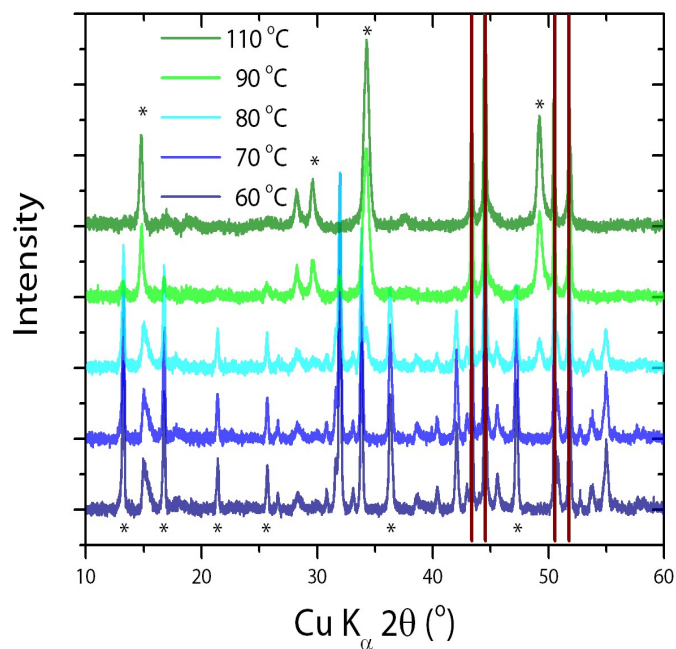


Figure S2: in situ X-ray diffraction patterns of  $\text{Li}_3\text{InCl}_6$  hydrate during dehydration. Red bars are from the Ni- and Cu-containing sample holder. Asterisks are on reflections used in full-width-half-maximum analysis.

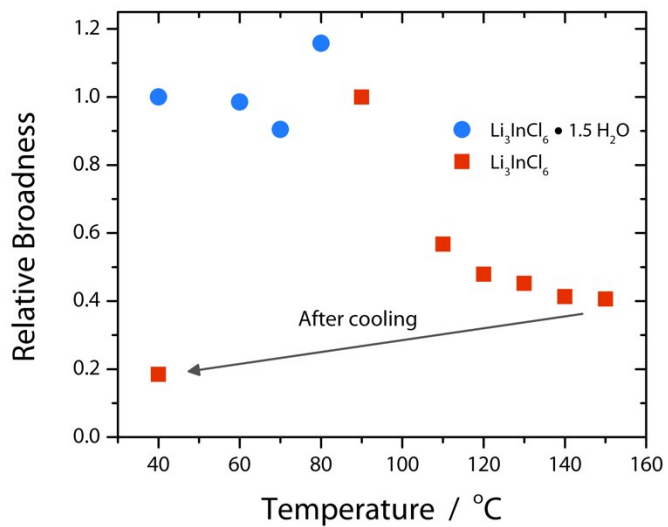


Figure S3. Evolution of the full-width-half-maximum of the  $\text{Li}_3\text{InCl}_6$  pellet's diffraction peak labels in Fig. S2. Relative broadness is defined as the average of the relative change in peak broadness.