Supplementary Information

One-pot hydrothermal synthesis of orientated delafossite $CuFeO_2$ films from a mildly acidic solution on substrates

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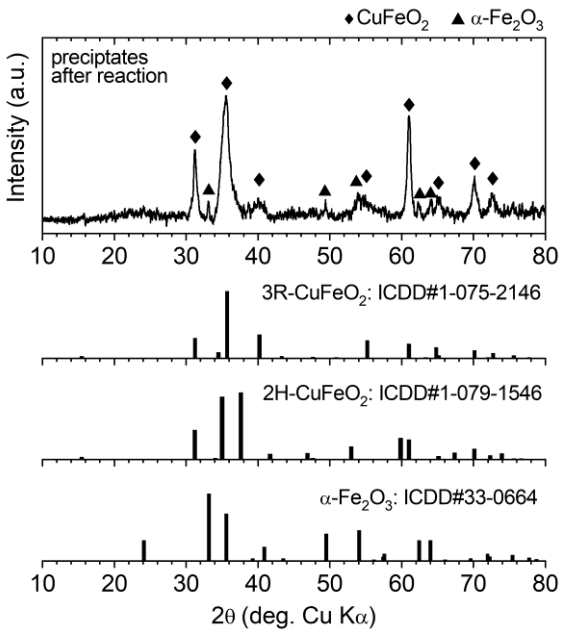

Figure S1. XRD pattern of black powder precipitated in a PTFE vessel after the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) at 150°C for 1 h. ICDD (no. 1-075-2146) for 3R-$CuFeO_2$, (no. 1-079-1546) for 2H-$CuFeO_2$ and (no. 33-0664) for α-Fe_2O_3 are presented.

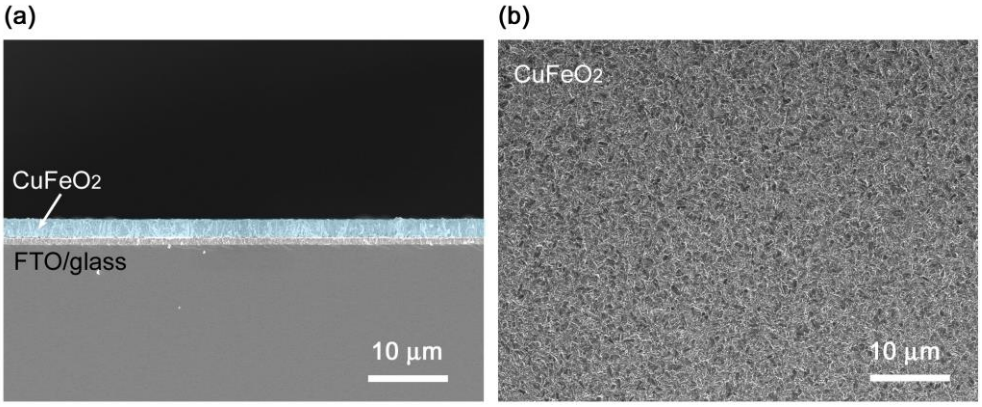

Figure S2. (a) Cross-sectional and (b) top-view FESEM images of the $CuFeO_2$ film deposited on FTO glass substrates via the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) at 150°C for 1 h.

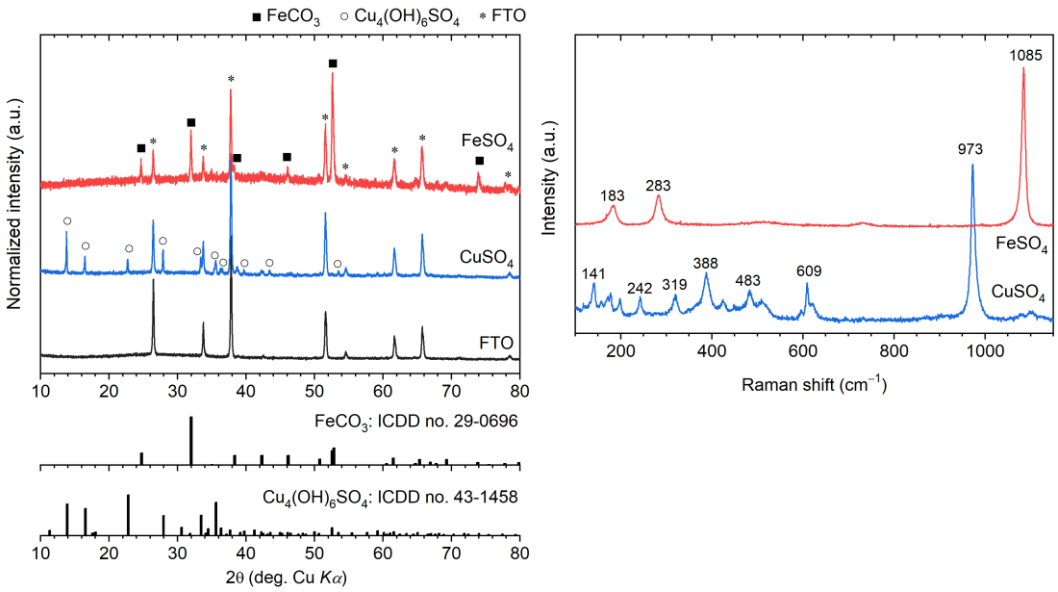

Figure S3. XRD patterns (left) and Raman spectra (right) of the films deposited on FTO glass substrates via the hydrothermal reaction in each $CuSO_4$–urea and $FeSO_4$–urea (aq) at 150°C for 1 h. ICDD (no. 29-0696) for $FeCO_3$ and (no. 43-1458) for $Cu_4(OH)_6SO_4$ are presented.

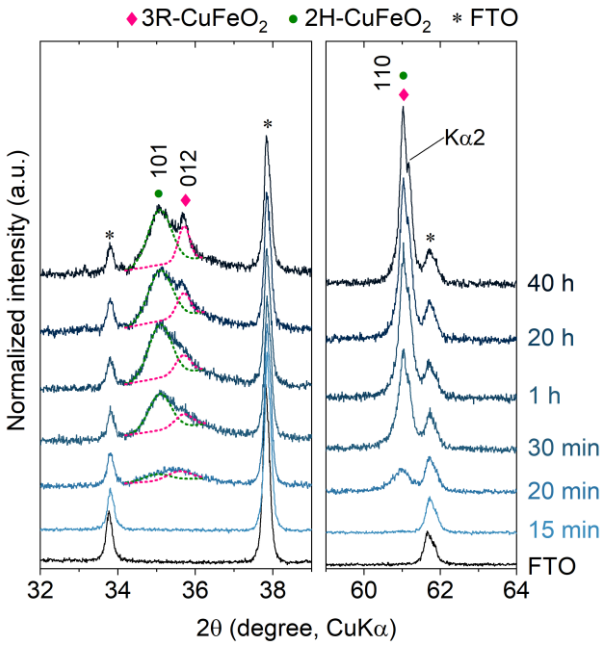

Figure S4. XRD patterns of the films deposited on FTO glass substrates via the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) at 150°C at different reaction times (15 min–40 h).

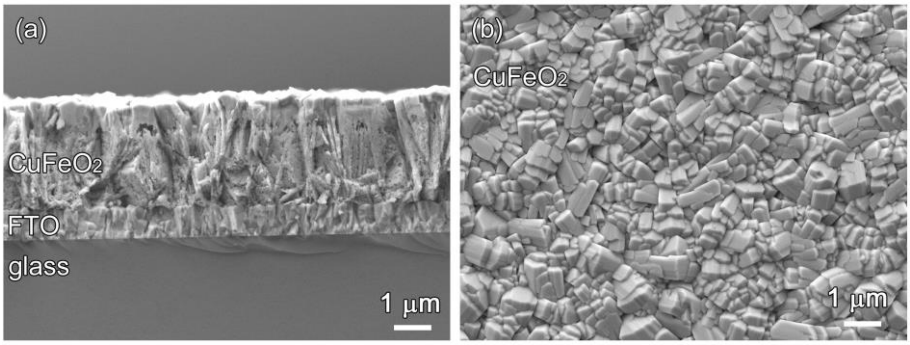

Figure S5. (a) cross-sectional and (b) top-view FESEM images of the $CuFeO_2$ film deposited on FTO glass substrates via the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) at 140°C for 1 h.

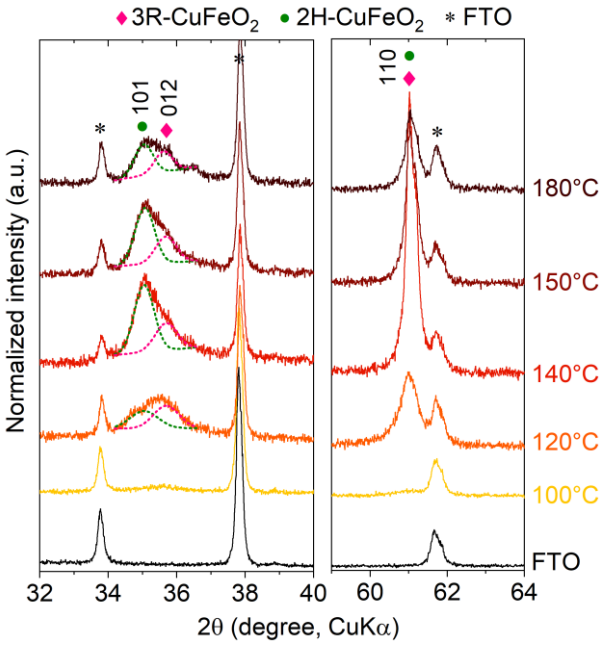

Figure S6. XRD patterns of the films deposited on FTO glass substrates via the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) for 1 h at different reaction temperatures (100°C–180°C).

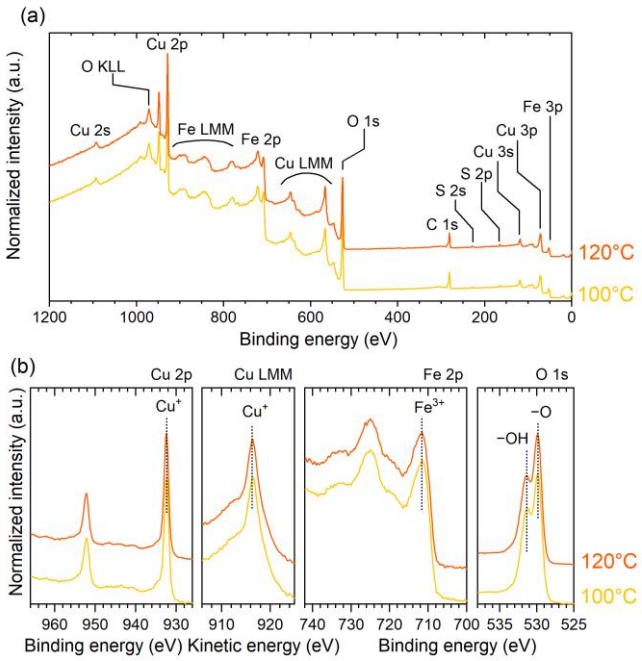

Figure S7. (a) wide-scan and (b) fine-scan XPS spectra of the films deposited on FTO glass substrates via the hydrothermal reaction in $CuSO_4$–$FeSO_4$–urea (aq) at 100°C–120°C for 1 h.

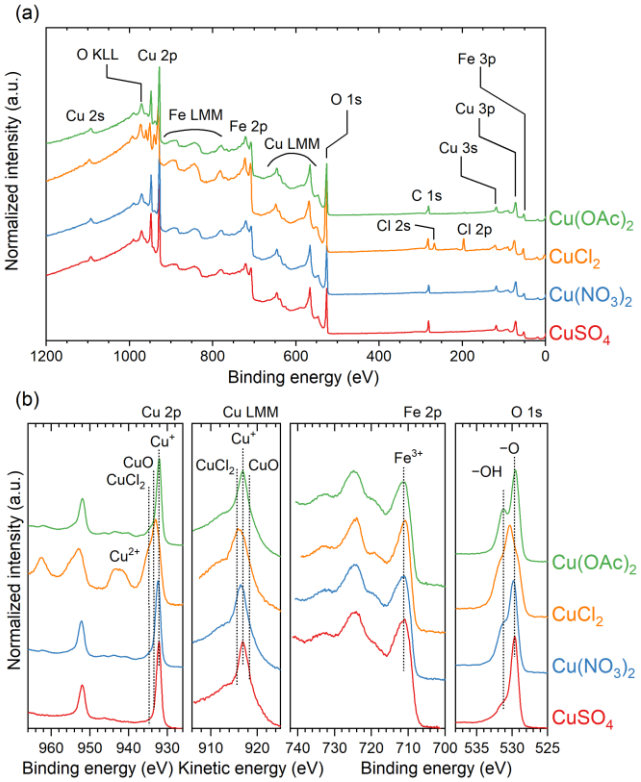

Figure S8. (a) wide-scan and (b) fine-scan XPS spectra of films deposited on FTO glass substrates by the hydrothermal reaction in each copper salt ($CuSO_4$, $Cu(NO_3)_2$, $CuCl_2$ and $Cu(OAc)_2$)–$FeSO_4$–urea (aq) at 180°C for 1 h.

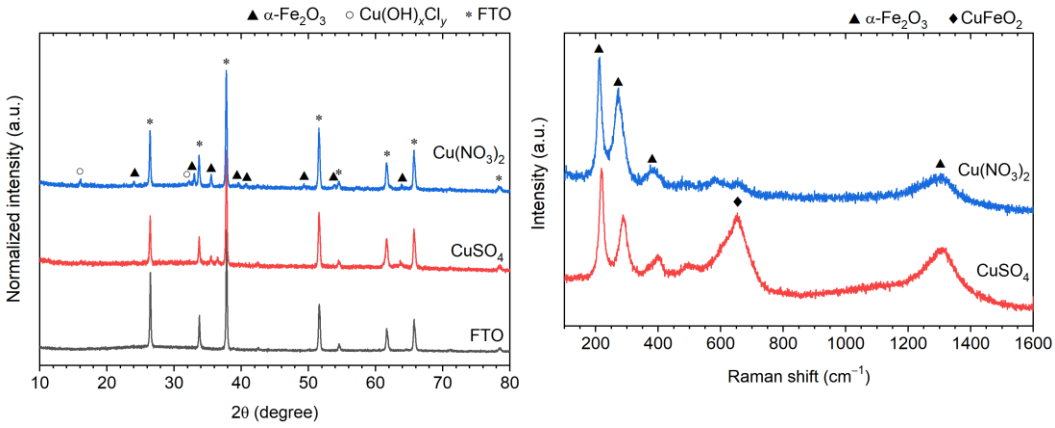

Figure S9. XRD patterns (left) and Raman spectra (right) of the films deposited on FTO glass substrates by the hydrothermal reaction in each copper salt ($CuSO_4$ and $Cu(NO_3)_2$)–$FeCl_2$–urea (aq) at 180°C for 1 h.