Solid-state batteries luanda

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Schematic of the construction of the highly stable HE-DRX | LLZTO interface using the UHS process: the high reaction temperature of the UHS technology enables the rapid synthesis of the HE-DRX positive electrode on the LLZTO surface, while the short sintering time and the stability of the HE-DRXs ensure a conformal positive electrode interface without any side reactions.

a Rapid synthesis of TM6 with UHS at 1100 ?C in 3 s. b XRD pattern of TM6 synthesized by UHS. c TEM-EDS mapping of the TM6 particle. d XPS spectra of Mn 2p. SEM images of TM2 (e), TM4 (f) and TM6 (g) sintered at 1150 ?C for 10 s. h Comparison of synthesis temperature and sintering temperature of TM2, TM4, and TM6.

a In situ XRD patterns of LLZTO and TM6. b DSC of TM2 and LLZTO, TM4 and LLZTO, and TM6 and LLZTO. EDS mapping (c) and Line profiles (d) of the TM6 | LLZTO interface. e TEM images of TM6 | LLZTO interface. f XRD patterns of LLZTO and TM6 heated by UHS. g Comparison of chemical stability between different positive electrodes and LLZTO. h Each individual component of TM6 vs LLZTO pseudobinary phase diagram. The most likely reaction products are shown in Supplementary Table 2.

a Schematic of the in situ synthesis of HE-DRXs on dense LLZTO. SEM images (b-d) and SEM/EDS mapping (e) of TM6 | LLZTO interface. f XRD of the in situ synthesized TM6. g Zoomed in EIS of TM6 symmetric cells. h EIS of LiCoO2 symmetric cells.

a Charge/Discharge profiles of the all-solid-state battery at different rates from 25 mA/g to 100 mA/g. XRD patterns (b) and SEM/ EDS images of the HE-DRX-ASSLBs c before and d after cycling. e Cycling performance and f Coulombic efficiency of the HE-DRX-ASSLBs at 25 mA/g. All electrochemical measurements were performed at 150 ?C without organic electrolyte and external pressure.

The crystal phases were examined by U1timaIV (Rigaku Corporation, Japan) XRD and scanned between 15? and 80? using Cu Ka radiation. To investigate the interface between the in situ-formed positive electrode and LLZTO, as well as the distribution of elements at the interface, SEM (FEI Apreo) and EDS spectra were employed at 20 kV. X-ray photoelectron spectroscopy (XPS) measurements were performed on an ESCALAB 250Xi (Thermo Scientific, UK) equipped with mono-chromated Al K alpha (energy 1486.68 eV). Raman

spectra of the HE-DRXs and LLZTO were obtained by a Horiba LabRAM HR Evolution Raman spectrometer with a laser wavelength of 532 nm. TEM/EDS (FEI Talos F200X) was used to analyze the distribution of various elements in the TM6 particle and TM6 | LLZTO interface.

The EIS spectra of the symmetric Au|TM6 | LLZTO | TM6|Au and Au|LCO | LLZTO | LCO|Au cells were tested using Bio-Logic (SP-200) with a frequency range of 7 MHz to 100 mHz and a temperature range of 25-150 ?C. EIS spectra of TM6-ASSLBs were investigated using Bio-Logic with a frequency range of 100 mHz to 1 MHz and a voltage of 30 mV. The galvanostatic charge/discharge of the TM6-ASSLBs was tested on a NEWARE (CT-4008Tn-5V10-mA-164) battery test system at 150 ?C with current densities of 25, 50, and 100 mA/g without any organic electrolyte.

The experiment data that support the findings of this study are available from the corresponding author upon request. Source data are provided with this paper.

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C.W. and X.K. designed and conducted the experimental work. Z.J. and R.P. carried out the computational study. X.K., R.G., and C.L. carried out the co-sintering experiments, electrochemical measurements, and SEM imaging. W.X. and X.L. created the schematics. H.H. and Y.X. helped prepare the samples and conduct the XRD measurements. C.W. and X.K. analyzed the electrochemical data. K.Z. measured the in situ X-ray diffraction. C.W., X.K., L.Z., and C.Z. wrote and revised the manuscript. All authors discussed the results and commented on the manuscript.