

Supplementary Information

Electrochemical Oxidative Dehydrogenation of Propane to Propylene in an Oxygen-ion Conducting Solid Oxide Electrolyzer

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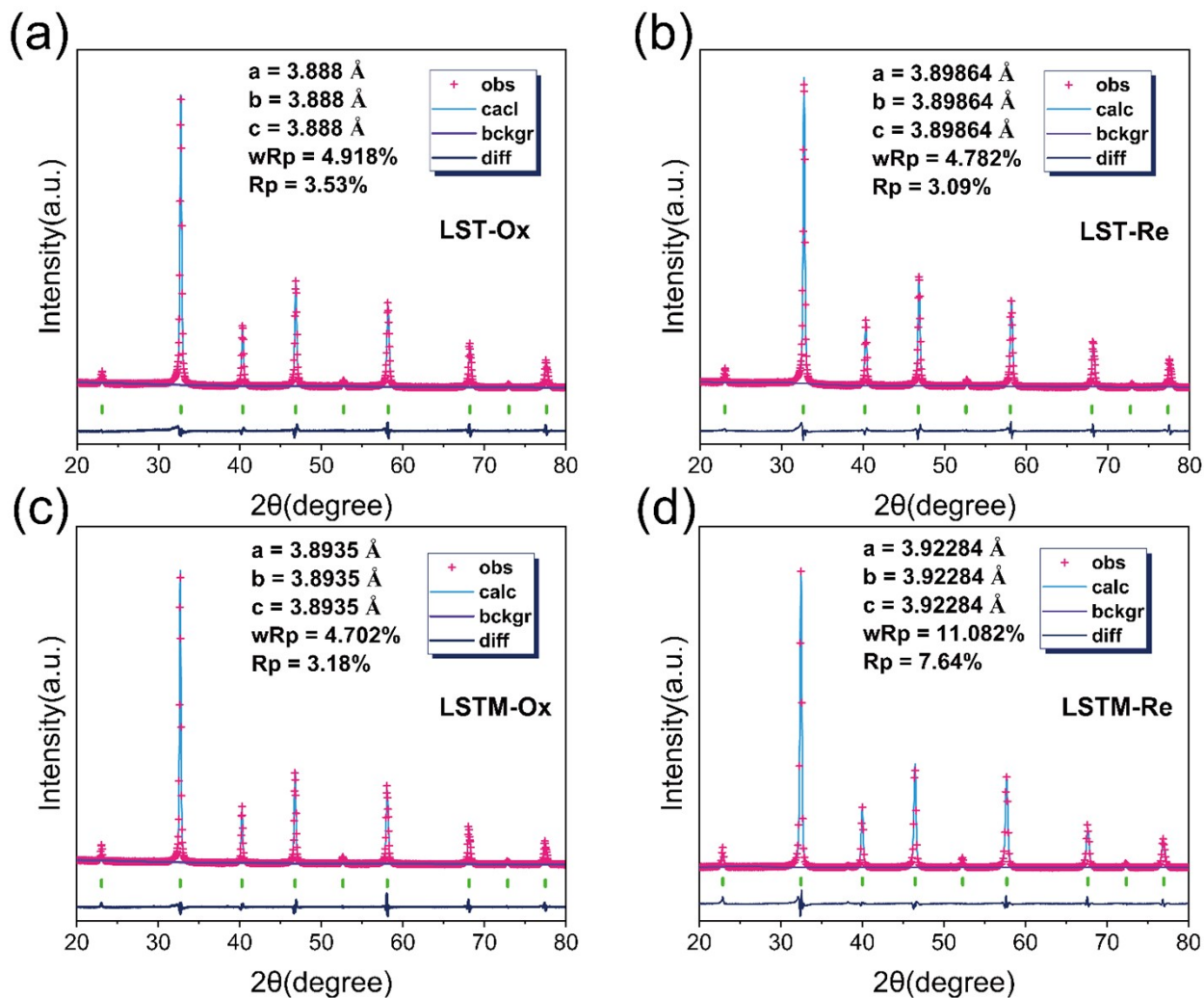


Fig. S1 XRD Rietveld refinement patterns of (a) oxidized and (b) reduced LST; (c) oxidized and (d) reduced LSTM.

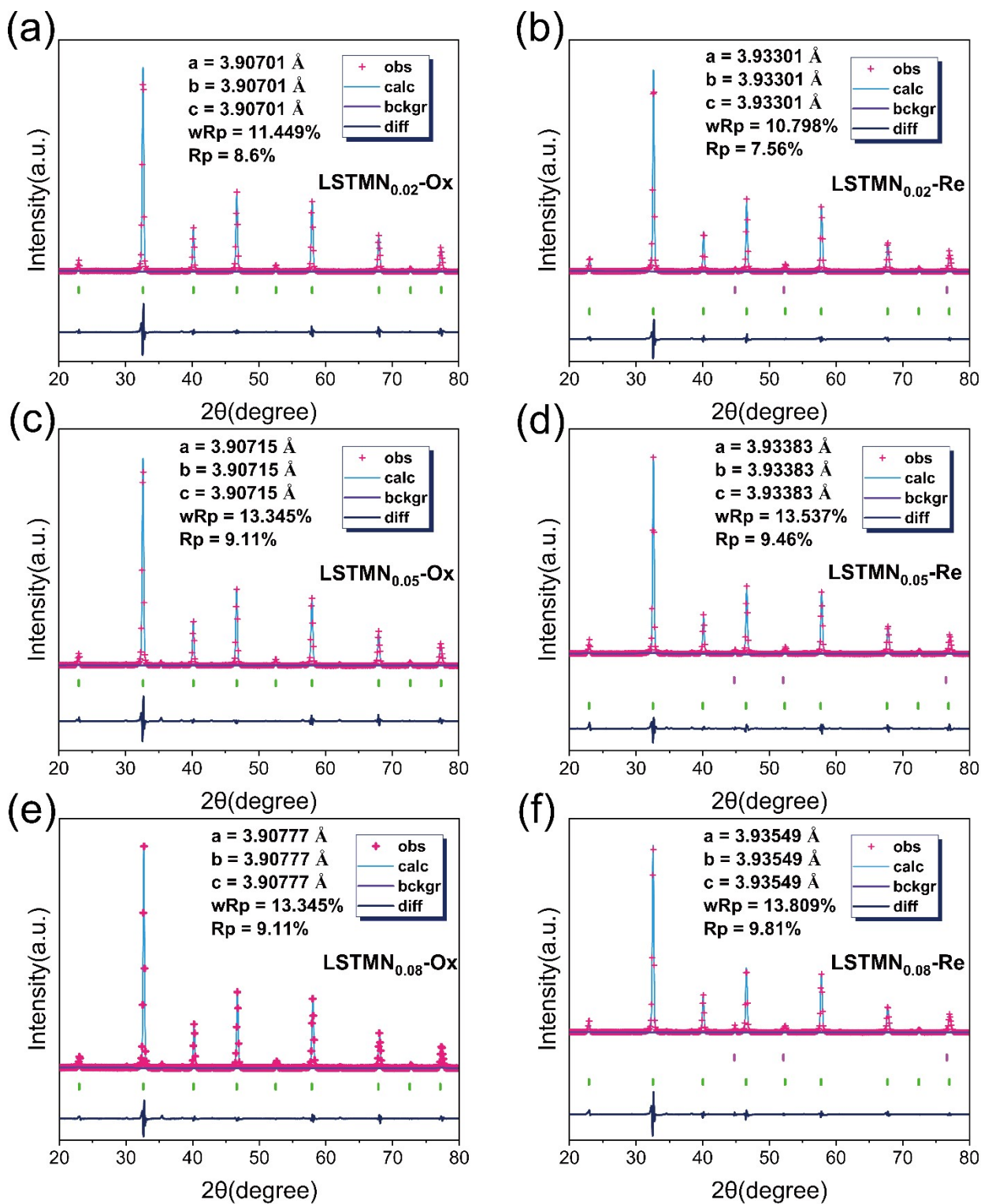


Fig. S2 XRD rietveld refinement patterns of the (a) oxidized and (b) reduced LSTMN_{0.02}; (c) oxidized and (d) reduced LSTMN_{0.05}; (e) oxidized and (f) reduced LSTMN_{0.08}.

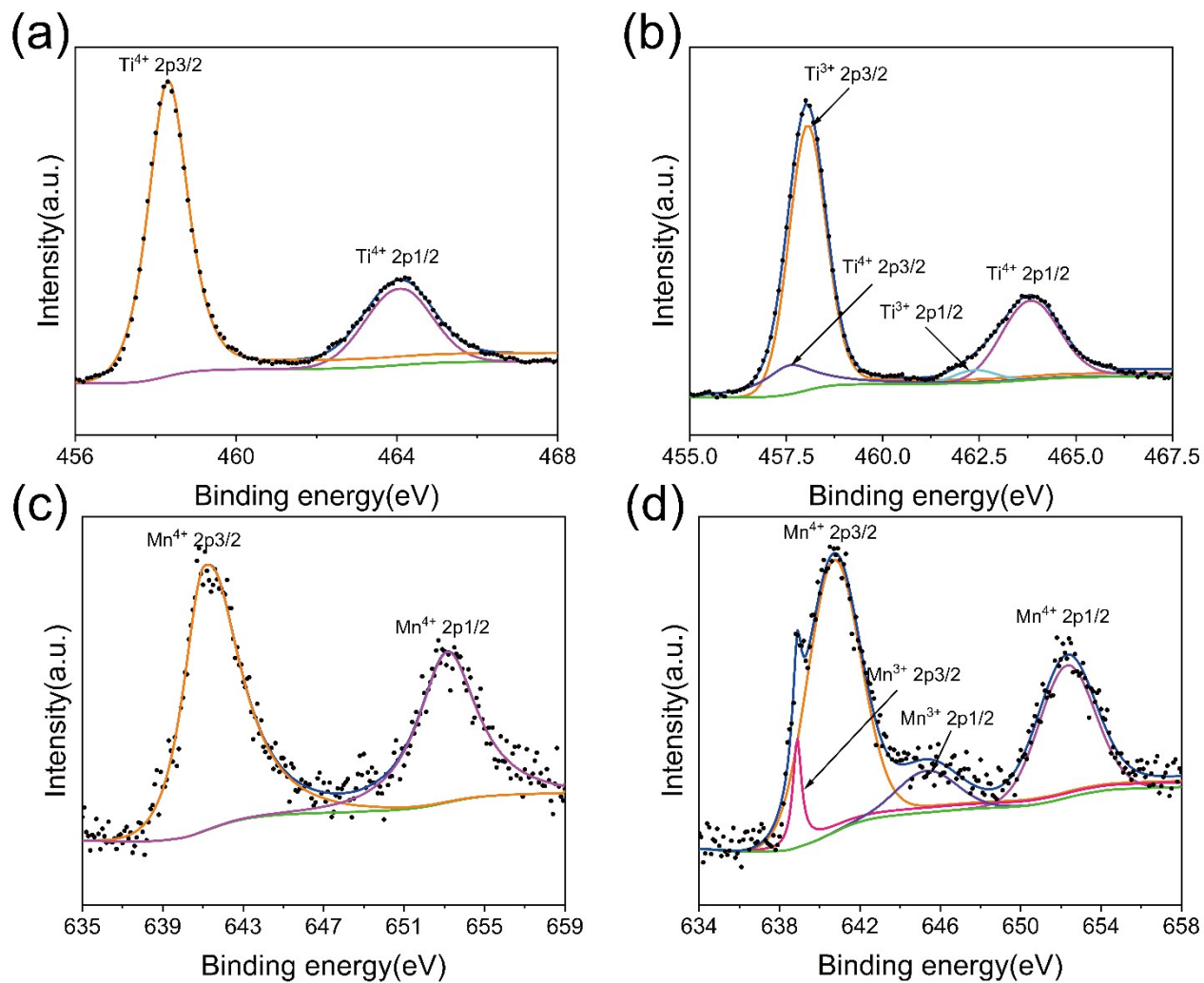


Fig. S3 XPS results of Ti and Mn in the (a, c) oxidized and (b, d) reduced LSTM, respectively.

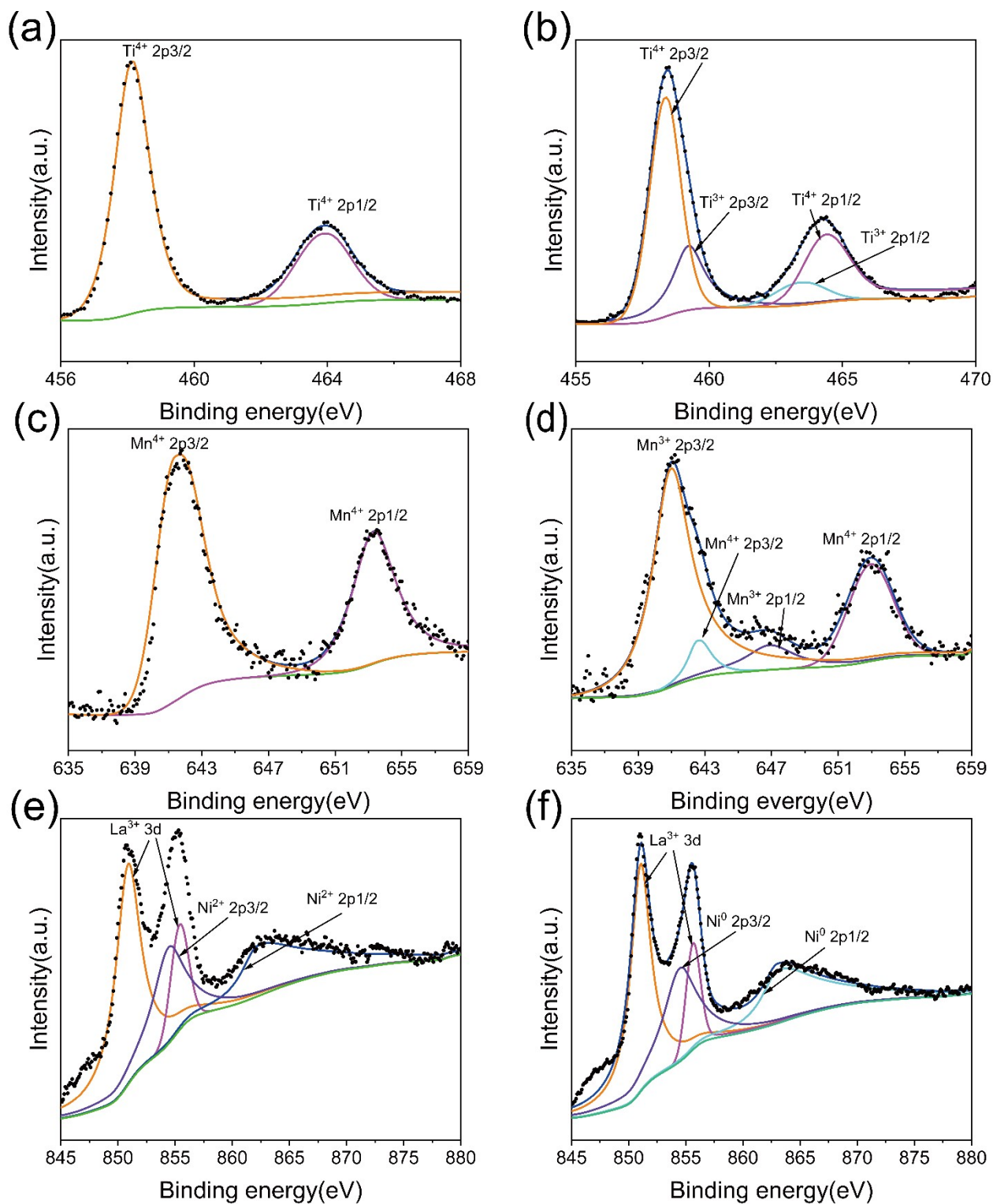


Fig. S4 XPS results of Ti, Mn, and Ni in the (a, c, e) oxidized and (b, d, f) reduced LSTMN_{0.1}, respectively.

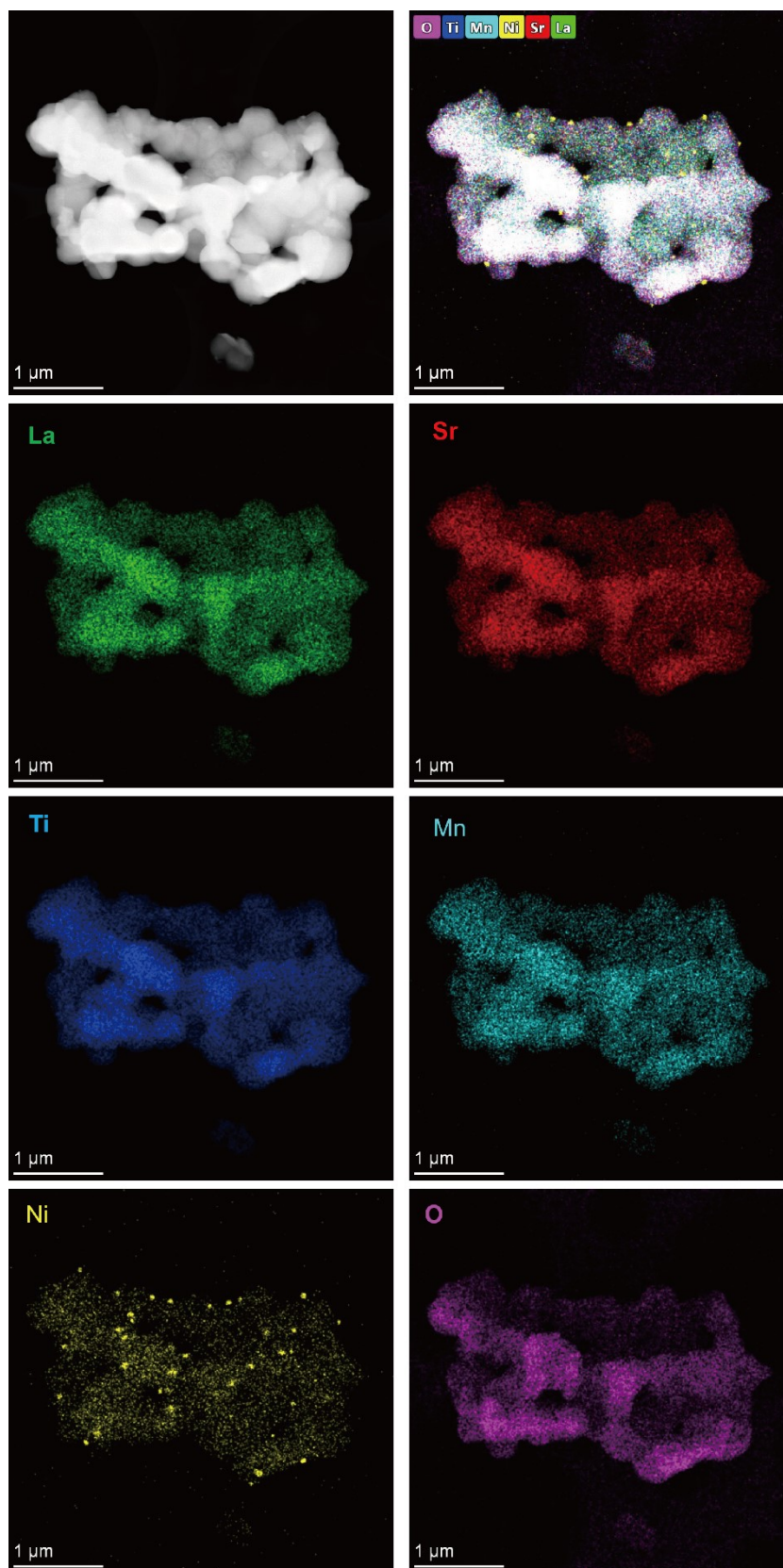


Fig. S5 HRTEM result of the mapping after LSTMN_{0.1} reduction.

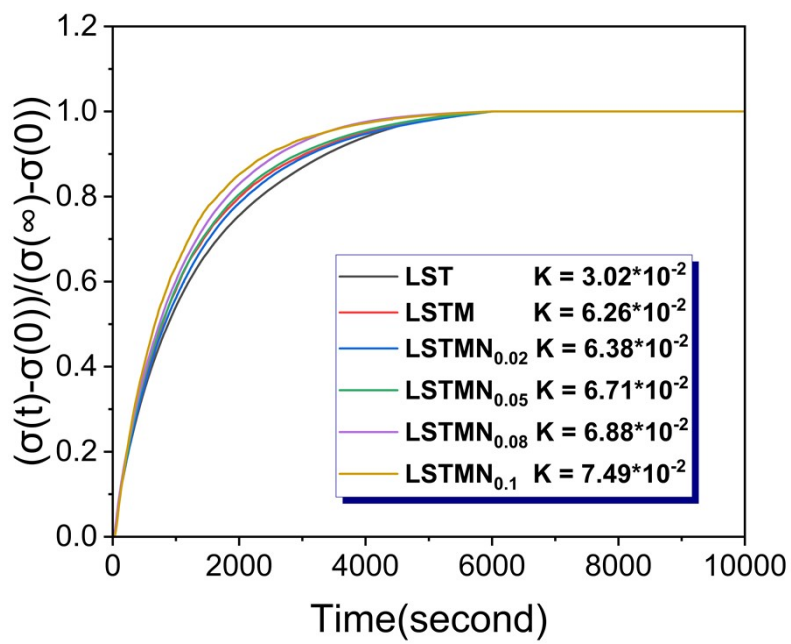


Fig. S6 Surface oxygen exchange coefficients of different electrode materials.

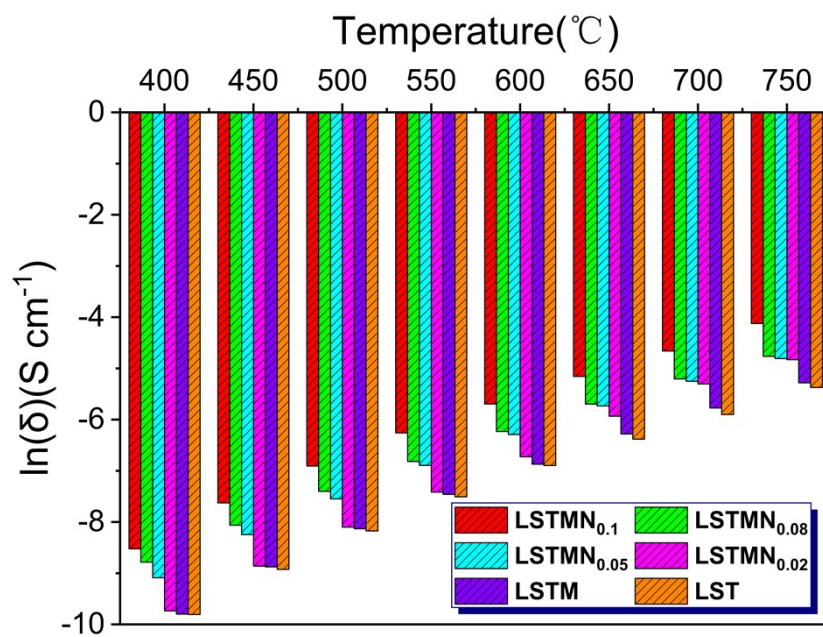


Fig. S7 The conductivity of different electrode materials in 5% H₂/Ar atmosphere.

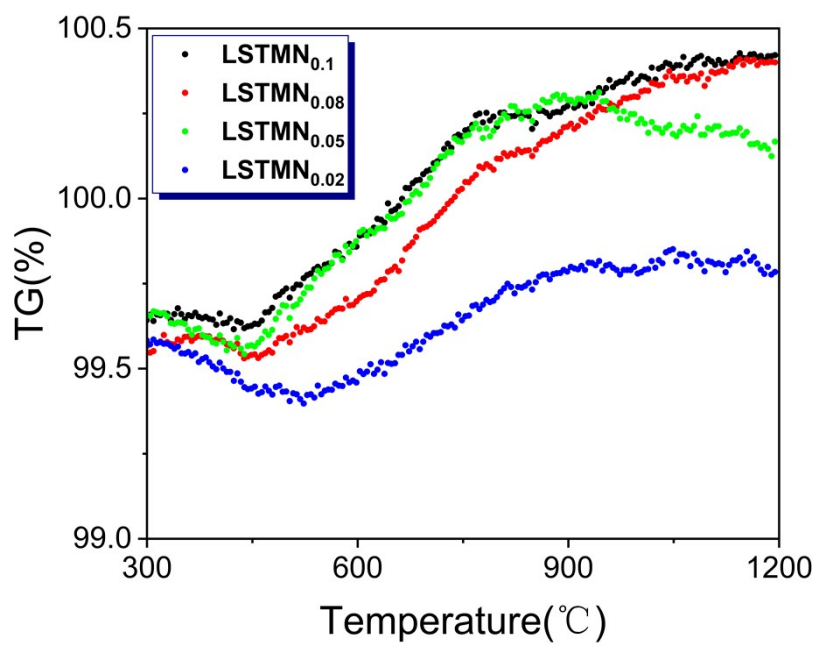


Fig. S8 TG tests of the reduced Ni-doped samples from 300 to 1200 °C in air.

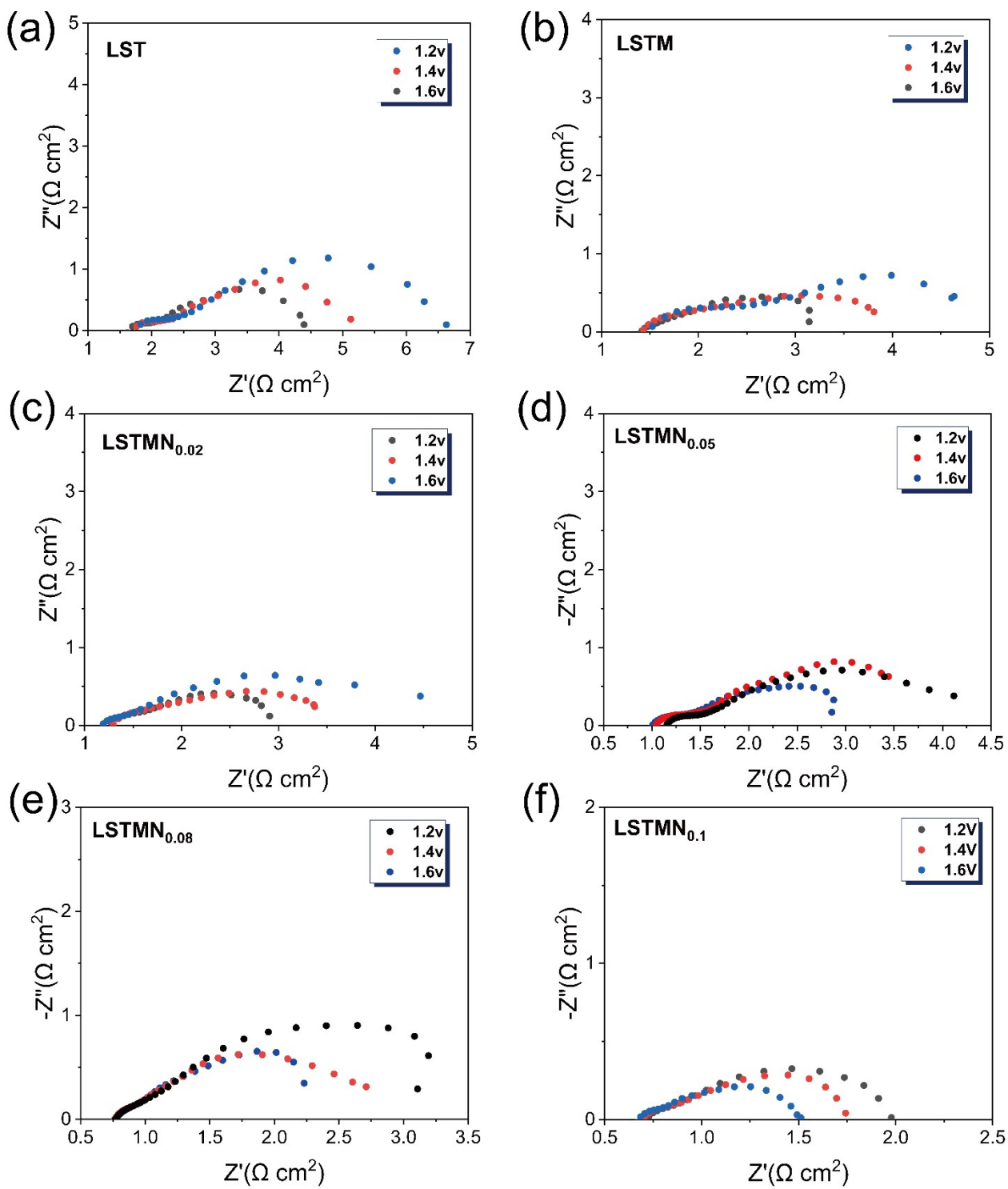


Fig. S9 AC impedance spectra of (a) LST, (b) LSTM, (c) LSTMN_{0.02}, (d) LSTMN_{0.05}, (e) LSTMN_{0.08}, (f) LSTMN_{0.1}.

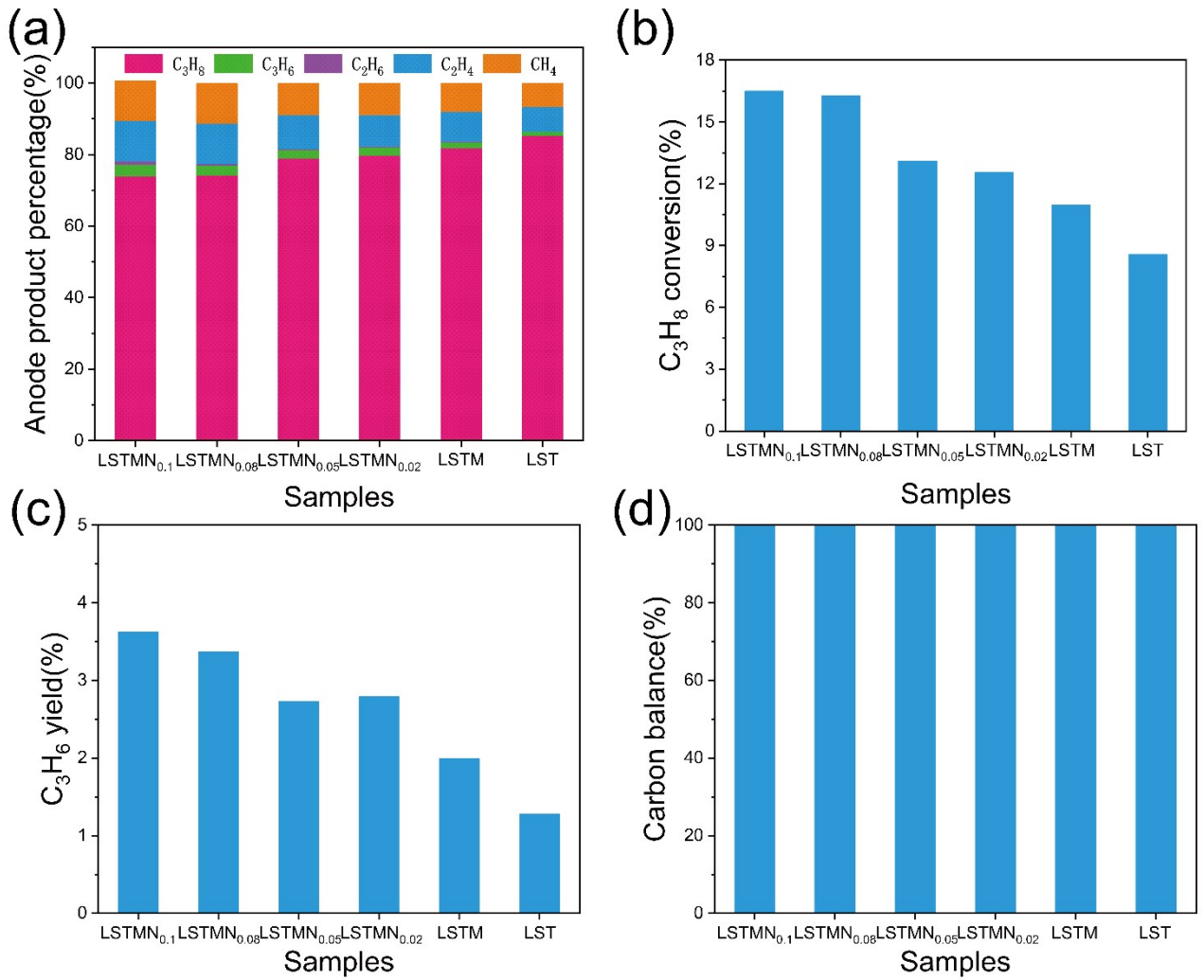


Fig. S10 (a) Analysis of the products of thermal decomposition of propane in the anode of a solid oxide electrolyzer without externally applied voltage at 700 °C. (b) Propane conversion. (c) Propylene yield. (d) Carbon balance.

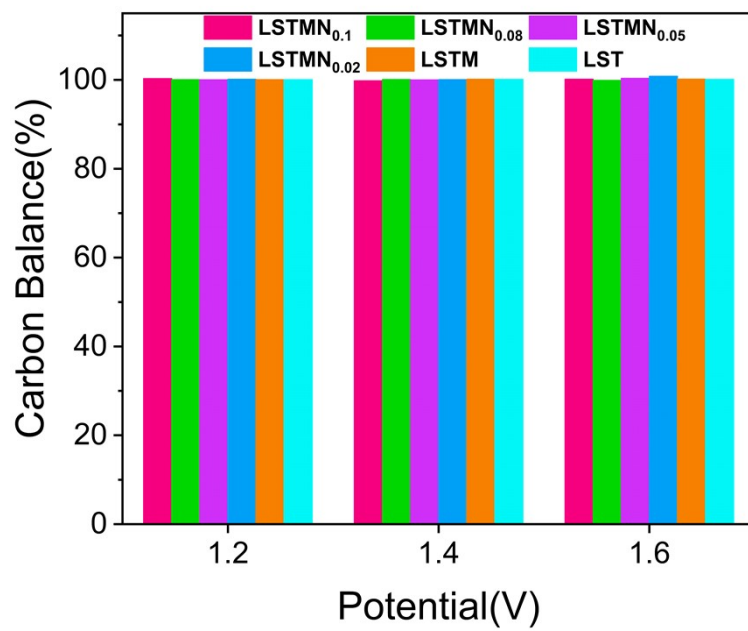


Fig. S11 Carbon balance of propane dehydrogenation for different electrode materials.

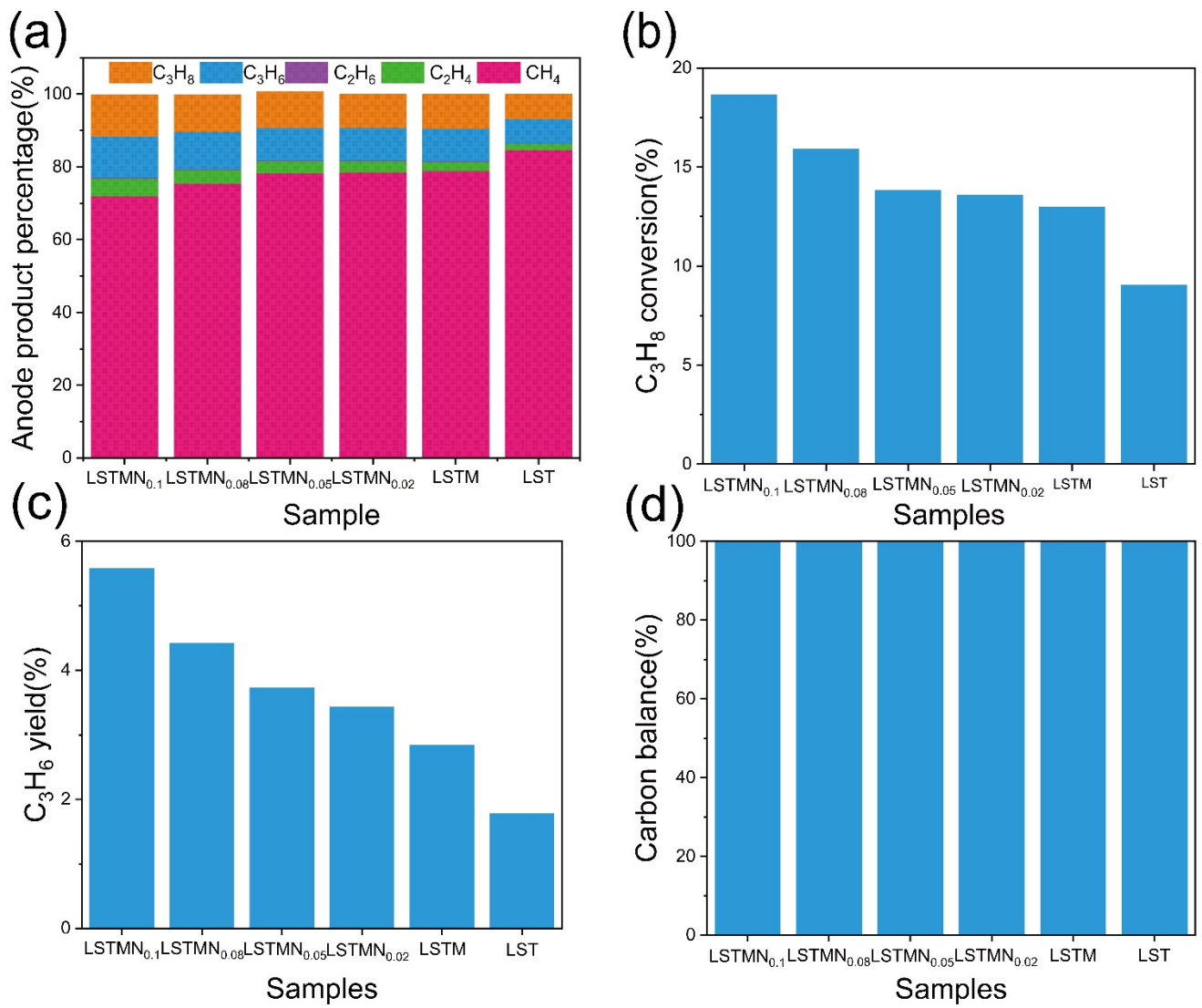


Fig. S12 (a) Analysis of the products of thermal decomposition of propane in the anode of a solid oxide electrolyzer at 700°C without applied voltage and with the addition of water vapor. (b) Propane conversion. (c) Propylene yield. (d) Carbon balance.

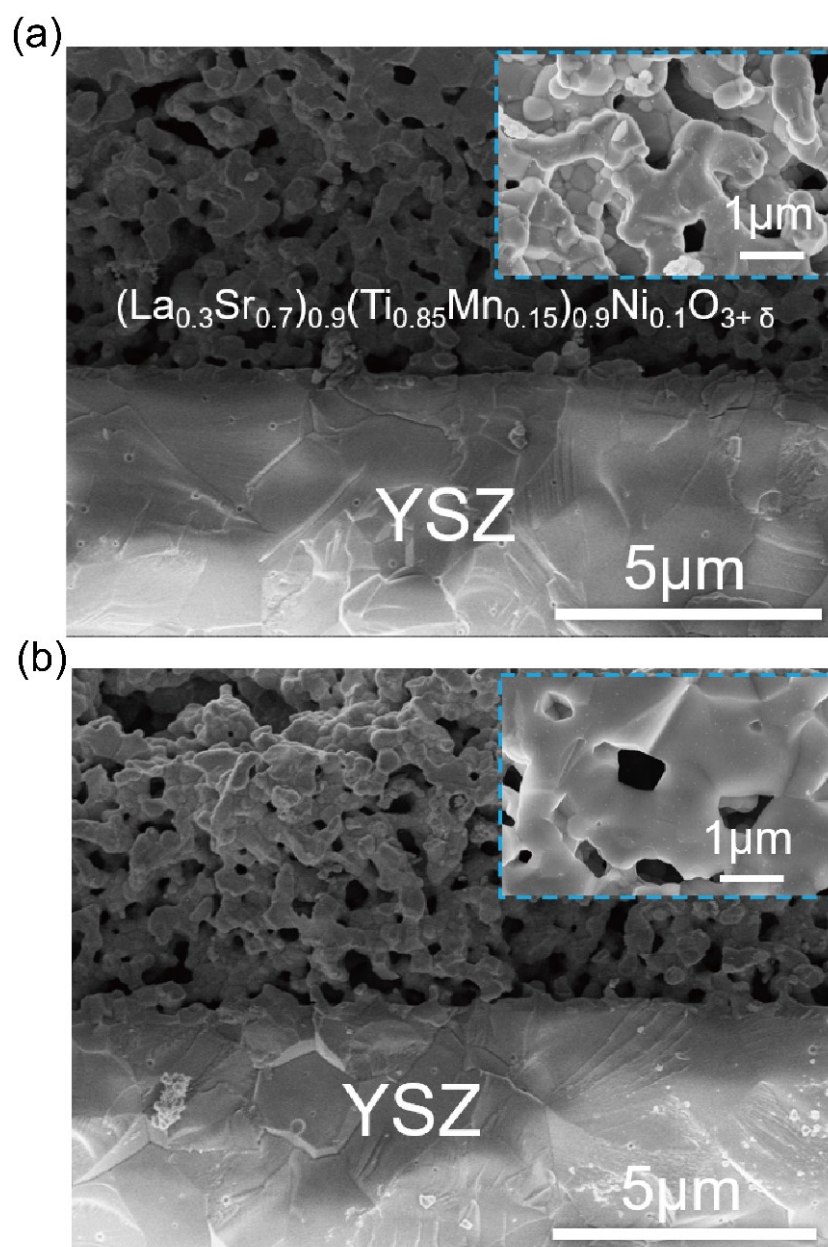


Fig. S13 (a) SEM image of the cell interface before the reaction. (b) SEM image of the cell interface after the reaction.

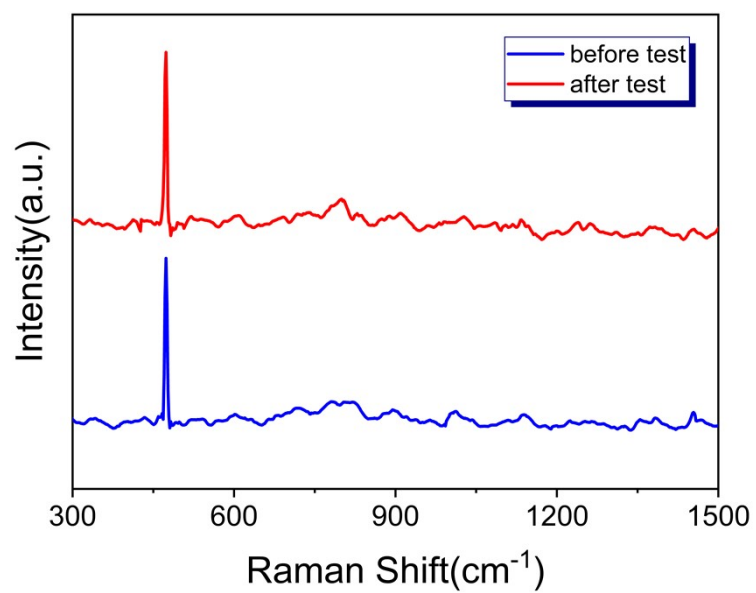


Fig. S14 Raman spectra are measured before and after the test.