

Electronic supplementary information

Conductivity origin and design principles of electrically controllable high conductive La-doped perovskite

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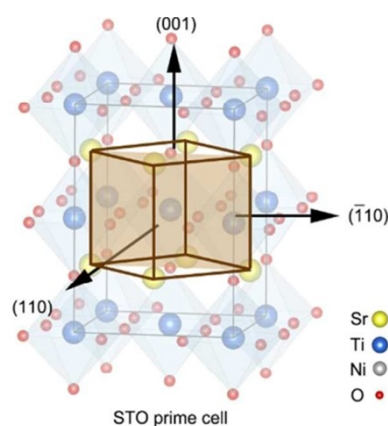


Fig. S1. SrTiO₃ (STO) primitive cell.¹

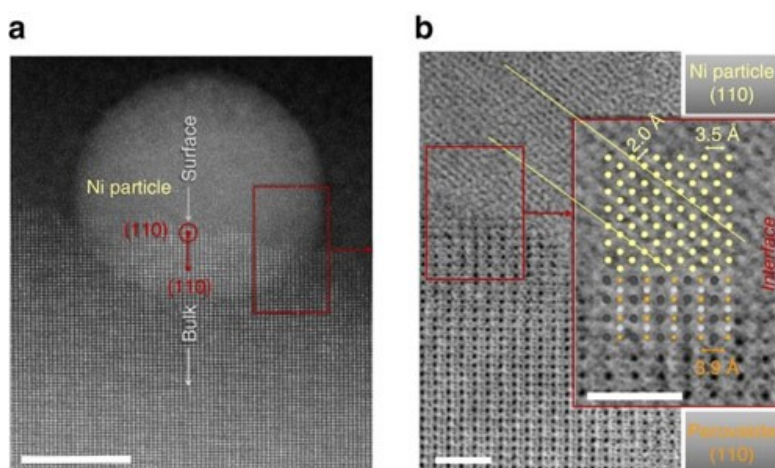


Fig. S2. (a) TEM micrograph (dark field) of a Ni particle exsolved on (110) native surface facet after ageing (~3% H₂O/5% H₂/Ar, 930 °C, 60 h); scale bar, 10 nm. (b) TEM micrograph detail (bright field) of the metal–perovskite interface highlighting the corresponding atomic planes and orientations; scale bars, 1 nm.²

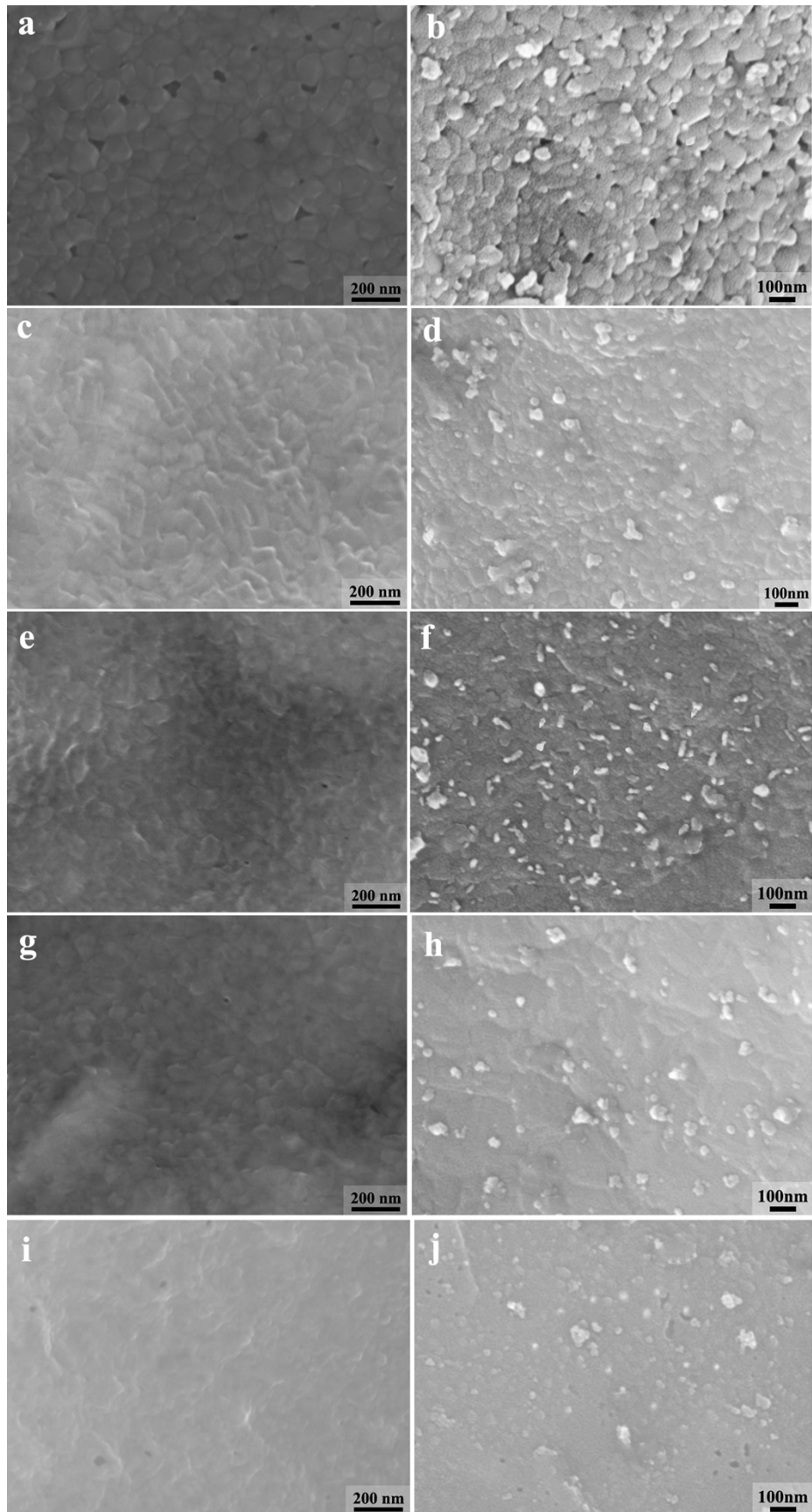


Fig. S3. SEM images of different La-doped samples before and after pulse electric current treatment comparing.

(a, b). La0, (c, d). La0.2, (e, f). La0.4, (g, h). La0.6, (i, j). La0.8.

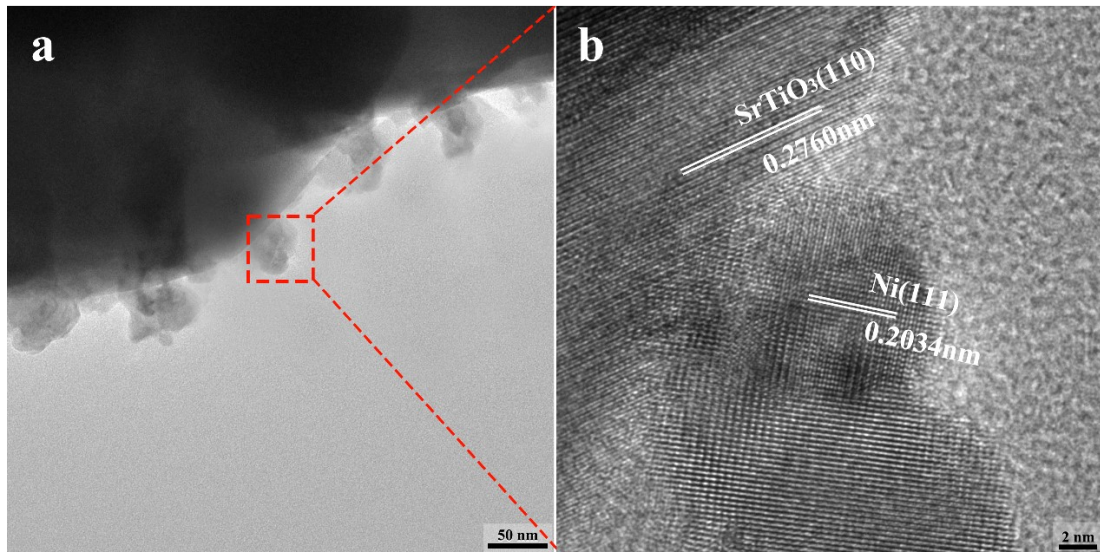


Fig. S4. Additional TEM images in this work demonstrate that Ni NPs exsolution.

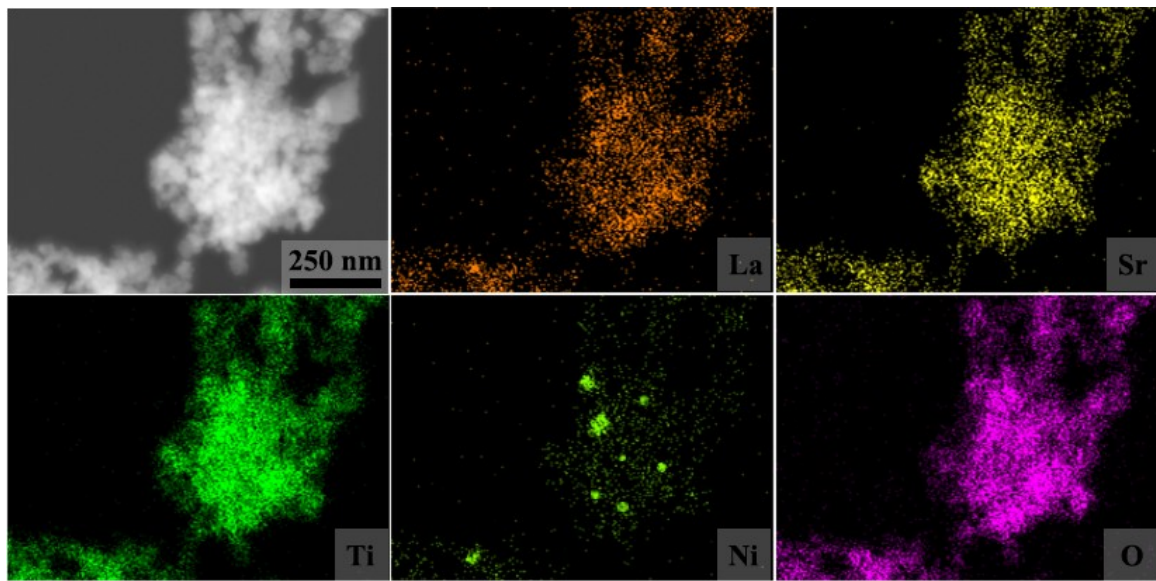


Fig. S5. the corresponding elemental mapping images of the LSTN.

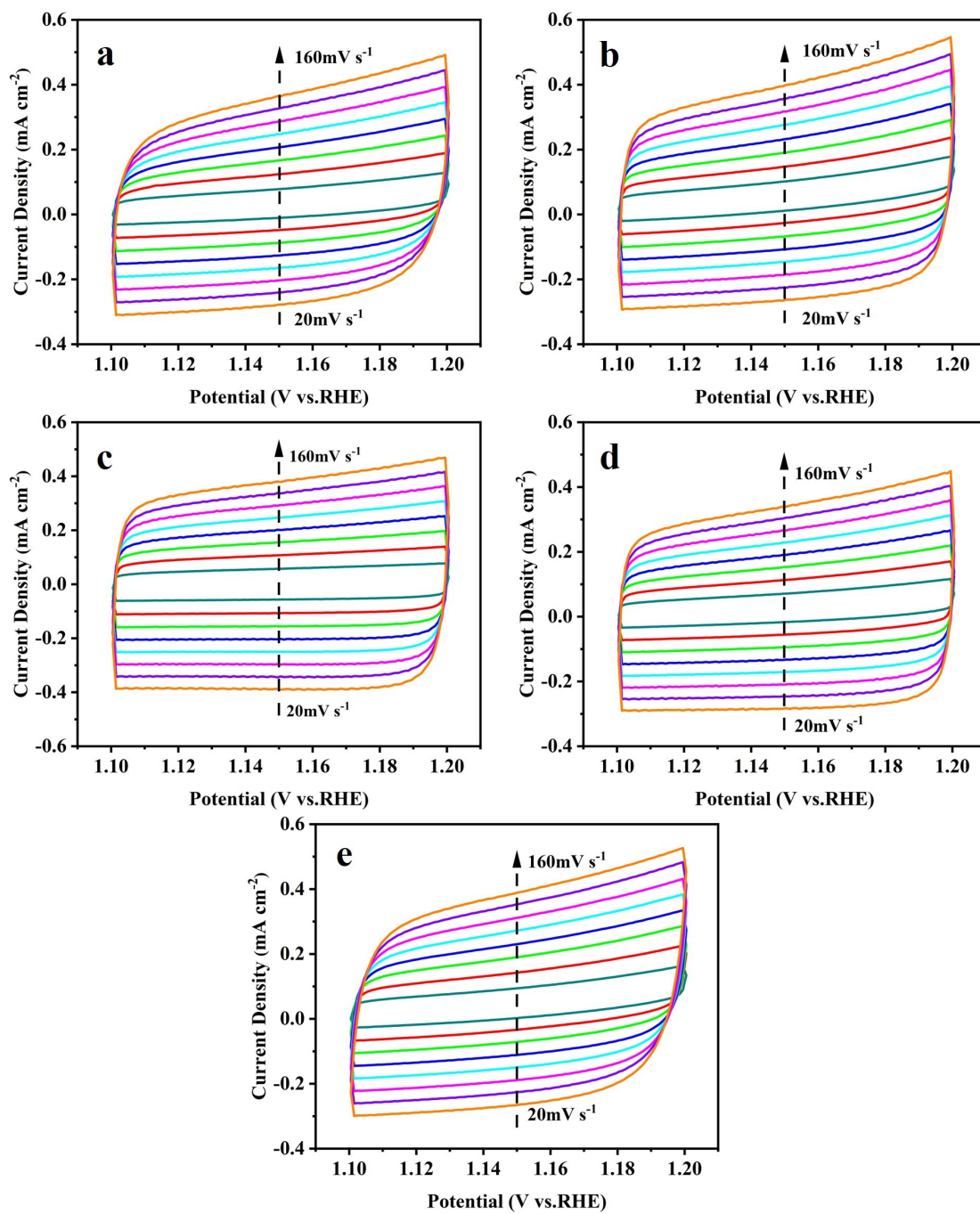


Fig. S6. Cyclic voltammetry (CV) graphs of (a). La0, (b). La0.2, (c). La0.4, (d). La0.6 and (e). La0.8 measured at different scan rates from 20 to 160 mV s⁻¹.

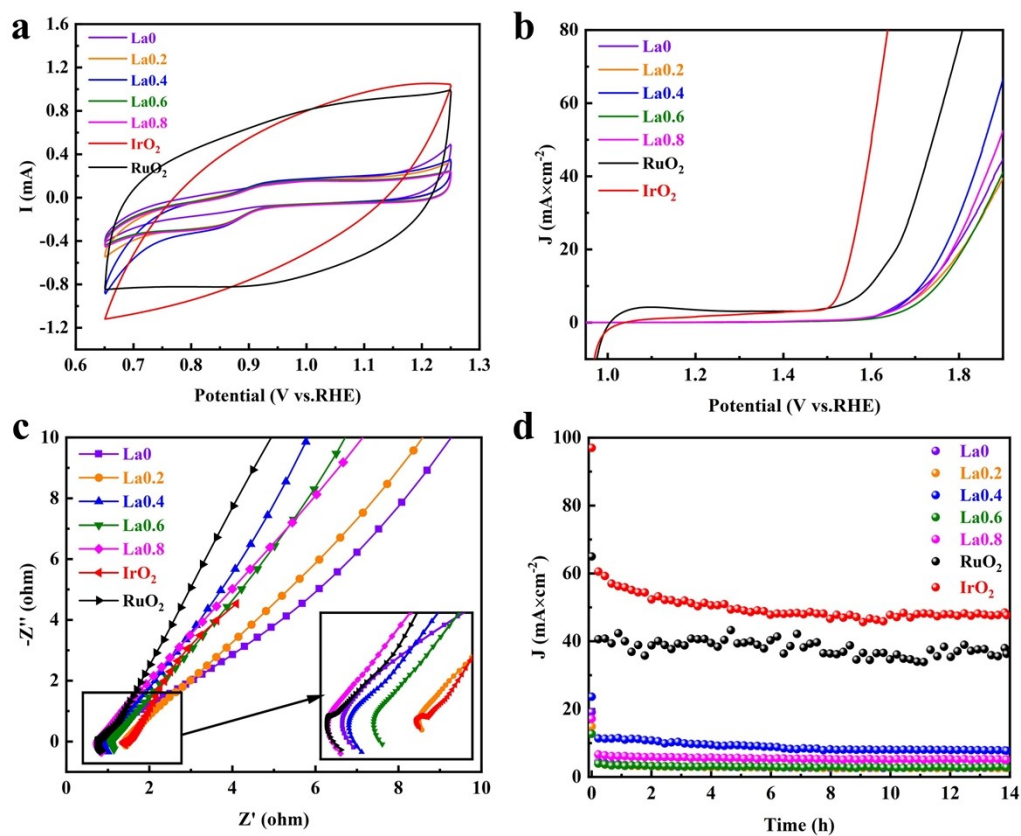


Fig. S7. Electrochemical curves of LSTN after PECINE, IrO₂ and RuO₂. (a). CV. (b). LSV. (c). EIS. (d). i-t.

Table S1 La doping quantity setting in model structure

Number of La doping	La doping ratio
0	0/7=0
1	1/7= 0.14285714
2	2/7= 0.28571428
3	3/7= 0.42857142
4	4/7= 0.57142857
5	5/7= 0.71428571
6	6/7= 0.85714285

References

- 1 Y. Gao, Z.H. Lu, T.L. You, J. Wang, L. Xie, J.Q. He, F. Ciucci, *J. Phys. Chem. Lett.*, 2018, **9**, 3772-3778.
- 2 D. Neagu, T.-S. Oh, D. Miller, H. Menard, S. Bukhari, S. Gamble, R. Gorte, J. Vohs, J. Irvine, *Nat. Commun.*, 2015, **6**, 8120.