

# Electronic Supplementary Material

## Advancing oxygen separation: insights from experimental and computational analysis of $\text{La}_{0.7}\text{Ca}_{0.3}\text{Co}_{0.3}\text{Fe}_{0.6}\text{M}_{0.1}\text{O}_{3-\delta}$ ( $\text{M} = \text{Cu}, \text{Zn}$ ) oxygen transport membranes

Guoxing Chen (✉)<sup>1\*</sup>, Wenmei Liu<sup>2\*</sup>, Marc Widenmeyer<sup>3</sup>, Xiao Yu<sup>1</sup>, Zhijun Zhao<sup>4</sup>, Songhak Yoon<sup>1</sup>, Ruijuan Yan<sup>3</sup>, Wenjie Xie<sup>1,3</sup>, Armin Feldhoff<sup>4</sup>, Gert Homm<sup>1</sup>, Emanuel Ionescu<sup>1,3</sup>, Maria Fyta (✉)<sup>5,6</sup>, Anke Weidenkaff<sup>1,3</sup>

1 Fraunhofer Research Institution for Materials Recycling and Resource Strategies IWKS, Alzenau 63755, Germany

2 Electrochemistry Laboratory (LEC), Paul Scherrer Institut, Villigen PSI 5232, Switzerland

3 Department of Materials and Earth Sciences, Materials and Resources, Technical University of Darmstadt, Darmstadt 64287, Germany

4 Institute of Physical Chemistry and Electrochemistry, Leibniz University Hannover, Hannover 30167, Germany

5 Institute for Computational Physics, University of Stuttgart, Stuttgart 70569, Germany

6 Computational Biotechnology, RWTH Aachen, Aachen 52074, Germany

E-mails: [guoxing.chen@iwks.fraunhofer.de](mailto:guoxing.chen@iwks.fraunhofer.de) (Chen G); [maria.fyta@rwth-aachen.de](mailto:maria.fyta@rwth-aachen.de) (Fyta M)

\* These authors contributed equally to this work.

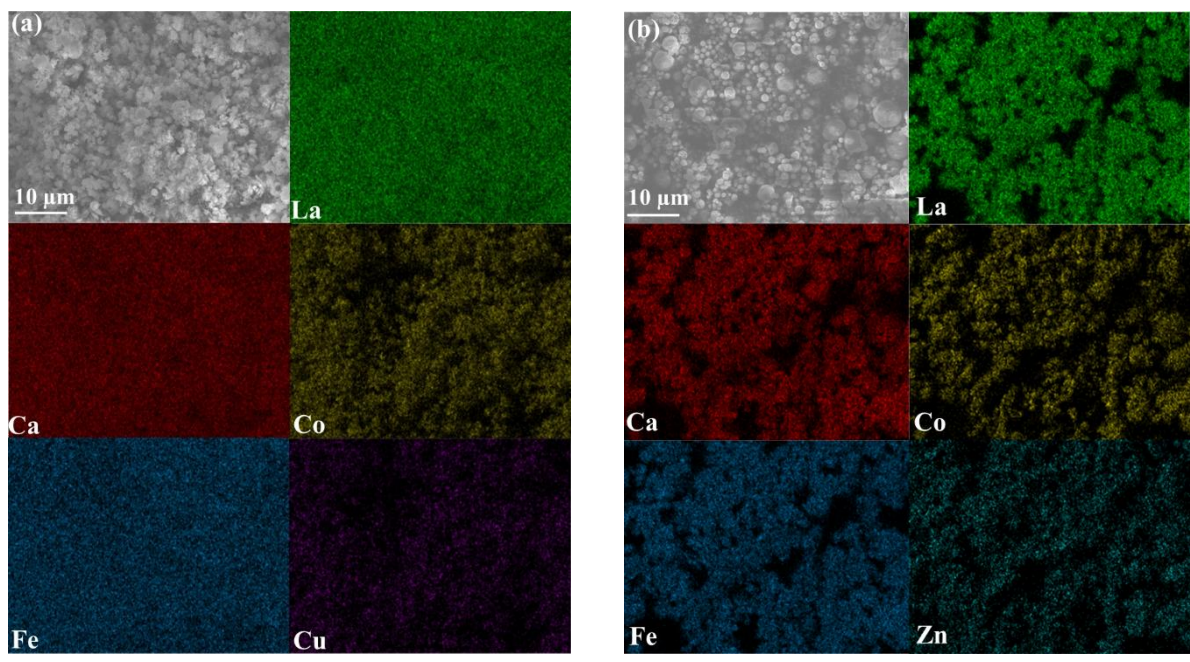


Figure S1. SEM images and EDXS elemental distribution of the (a)  $\text{La}_{0.7}\text{Ca}_{0.3}\text{Co}_{0.3}\text{Fe}_{0.6}\text{Cu}_{0.1}\text{O}_{3-\delta}$  and (b)  $\text{La}_{0.7}\text{Ca}_{0.3}\text{Co}_{0.3}\text{Fe}_{0.6}\text{Zn}_{0.1}\text{O}_{3-\delta}$  powders.