Abstract Submitted
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Epitaxial SrCoOx oxygen sponge[1] H.N. LEE, H. JEEN, W.S. CHOI, M.D. BIEGALSKI, D. SHIN, M.F. CHISHOLM, Oak Ridge National Laboratory, USA, C.M. FOLKMAN, D.D. FONG, J.W. FREELAND, Argonne National Laboratory, USA, I-C. TUNG, Northwestern University, USA, H. OHTA, Hokkaido University, Japan — Perovskite-based transition metal oxides have been actively developed as the replacements of noble metal-based electrodes in energy and environmental devices due to their high catalytic activity and ionic conductivity. However, the high thermodynamic barrier and the robust cation's oxidation state have limited the realization of fast catalysis and bulk diffusion at low temperature, which can reduce thermomechanical degradation in such devices. Here, we report a low-temperature reversible redox reaction in SrCoO_x grown directly by pulsed laser epitaxy as one of two distinct crystalline phases, either the perovskite $\mathrm{SrCoO}_{3-\delta}$ or the brownmillerite $\mathrm{SrCoO}_{2.5}$.[2] Based on real-time temperature dependent x-ray diffraction, we found that the distinct valence state in each phase can be reversibly switched at a remarkably reduced temperature (200 $\sim$ 300 °C) in a considerably short time (<1 min) without destroying the parent framework. Therefore, our results on low temperature reversible redox reactions provide valuable insight not only in understanding the structure-physical property relationship in multivalent oxides, but also for developing new strategies to avoid thermomechanical degradation in high temperature electrochemical devices, such as solid oxide fuel cells.

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[2] H. Jeen *et al.*, Nature Mater. **12**, 1057 (2013).

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