**Low temperature redox reactions in epitaxial oxygen sponge**

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Transition metal oxides (TMO) have shown diverse physical properties: metal-insulator transition, superconductivity, thermoelectric effect, magnetism, ion conductivity, catalytic activity, and etc. Among them, mixed ionic and electronic conducting behaviors in TMO have attracted lots of attentions for many energy devices such as solid oxide fuel cells and electrochemical sensor applications, where redox reactions and catalytic activity at the interfaces of gas-solid play critical roles for the performance of such devices. However, high ionic conduction and catalytic activity in TMO have only been achieved at elevated temperature. To avoid thermally induced degradation, many efforts have been pursued to reduce the working temperature for prolonged, reliable operation. In this talk, fast reversible redox reactions in epitaxial oxygen sponge, SrCoO*x* (2.5 ≤ *x* ≤ 3.0) at low temperature will be presented. Epitaxially stabilized two SrCoO*x* phases, i.e. oxygen-vacancy-ordered SrCoO2.5 and SrCoO3, by pulsed laser epitaxy were used for testing redox and catalytic activities[1-3]. Main discovery is that those two phases can be reversibly transformed at drastically reduced temperatures (< 200 oC) in considerably short time from real-time temperature dependent XRD and optical ellipsometry measurements. In addition, tests of catalysis using epitaxially oriented thin films provide useful strategy for designing highly sensitive electrochemical devices [4]. Lastly, recent works on strain dependent oxygen activity will be briefly presented.

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

[3] W.S. Choi *et al.*, Phys. Rev. Lett., **111,** 097401 (2013).

[4] H. Jeen *et al.*, Adv. Mater., **25,** 6459 (2013).