OAK RIDGE NATIONAL LABORATORY
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Strain Enhancement of Functional Oxygen Defects in Electrochemical Metal Oxides

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Technology Summary

Oxygen defects are playing an expanding role in the development of functional materials essential to green technology, driving advances ranging from energy storage to superconductivity. The present invention demonstrates for the first time that epitaxial strain can precisely tailor the concentration of oxygen defects in transition metal oxides (TMOs) at low to moderate temperatures (25 – 600 °C). Under these conditions, defects, such as oxygen vacancies, can enhance catalytic activities critical to electrochemical devices, including alkaline fuel cells and batteries. Increased oxygen vacancy concentration enables improvements to catalytic activity of a TMO by over an order of magnitude, greatly surpassing catalytic performance of Pt, and are comparable to that of state-of-the-art Ir when highly strained. The invention thus provides a basis for designing a new class of advanced oxide materials where strain, and not doping or ambient conditions, is the key tuning parameter of functional oxygen defects.

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