TCSUH Bi-Weekly Seminar

Oxygen Storage Materials: Perovskite Oxides Containing Manganese

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Room 102, Houston Science Center
12:00 p.m. – 1:00 p.m.

ABSTRACT: Non-stoichiometric oxides which show rapid and reversible oxygen uptake/release behavior at moderate temperatures are called oxygen storage materials (OSMs). These materials have recently attracted interest for a wide range of oxygen-related applications in which a precise control of the oxygen partial pressure (pO_2) in a redox reaction is required, for example in oxygen enrichment, oxygen separation, syngas production, catalytic oxidation of hydrocarbons and solar thermochemical water splitting.

An oxygen storage material is generally characterized by its oxygen storage capacity, the oxygen uptake/release kinetics, and phase stability under operating conditions. Several different classes of OSMs have been studied with different storage capacities, redox chemistry and catalytic properties. Oxides with the perovskite structure where the redox chemistry can readily be controlled by cation substitution are of current interest. Perovskite oxides can have wide ranges of oxygen non-stoichiometry, fast ambipolar bulk oxygen transport, and rapid surface reactions. In particular, oxides containing manganese, for example $LnBaMn_2O_{5+\delta}$, have outstanding oxygen storage properties, highly reversible oxygen uptake/release characteristics, and fast reaction kinetics below 500 °C. The theoretical oxygen storage capacity of the $YBaMn_2O_5$-$YBaMn_2O_6$ system is ~2400 μmol-O/g or ~3.85 wt % which is significantly higher than that of commercial $Ce_{1-x}Zr_xO_{2-\delta}$.

The synthesis of $LnBaMn_2O_{5+\delta}$ (Ln = Y, Gd, Eu, Sm, Nd, and Pr) phases and the effects of rare earth substitution on the oxidation/reduction kinetics and thermodynamics will be discussed. The non-stoichiometric behaviors of three systems $LnBaMn_2O_{5+\delta}$ (Y, Gd, Pr) determined by Coulometric titration in sealed electrochemical cells under near-equilibrium conditions, allow a quantitative comparison of their thermodynamic properties.

BIO: Allan J. Jacobson received a B.A. in Chemistry from St. Catherine's College, Oxford in 1966, and M.A., and D.Phil. degrees in Chemistry from New College, Oxford in 1969. He continued at Oxford doing post-doctoral research in the Inorganic Chemistry Laboratory until 1970 when he was appointed as Fellow and Tutor in Chemistry, Keble College, and Departmental Demonstrator in Inorganic Chemistry. In 1976, Dr. Jacobson moved to the United States to take up a senior research position in the Corporate Research Laboratories of Exxon Research and Engineering Company. In 1991, he left Exxon and joined the faculty of the University of Houston as Robert A. Welch Chair in Science and Professor of Chemistry and Chemical Engineering. Dr. Jacobson's research interests are in inorganic solid-state synthesis and in solid-state ionics related to ion transport membranes and fuel cells. He has published over 460 papers, 10 book chapters, and 50 patents.

RSVP by Wednesday at Noon to bdherndo@central.uh.edu for sandwiches.

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