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Mixed-Conducting Oxides under Extreme Oxygen Partial-Pressures. J.W. Richardson, Jr., Yaping Li, Evan R. Maxey, IPNS Div., Argonne National Laboratory, Argonne, IL 60439.

Dense ceramic components with mixed-conduction properties and high oxygen permeability are important as membranes for oxygen separation and solid oxide fuel cell applications. Many of the most promising are perovskite-derived oxides, due to their structural stability over large ranges of chemical composition and oxygen vacancy concentration. Membranes are typically operated at elevated temperatures (800-1000°C) and exposed to large oxygen partial pressure (pO_2) gradients.

The General Purpose Powder Diffractometer (GPPD) at the Intense Pulsed Neutron Source (IPNS) at Argonne is equipped with a specially designed controlled-atmosphere furnace, where samples in pellet or hollow-tube form are exposed to mixtures of gases to control oxygen and/or hydrogen content from highly oxidizing to highly reducing. Using two separate gas delivery "circuits", simulated membrane operation conditions can be achieved whereby the responses of oxygen-permeable membranes to strong pO_2 gradients can be studied.

Neutron diffraction offers significant advantages over x-ray diffraction, by resolving subtle oxygen content changes, measuring potential cation ordering and providing bulk (spatially-averaged) structural data. Results from the $Sr_2Fe_2CoO_{6-\delta}$ (multi-phase composite), $Sr(Fe,Co)O_{3-\delta}$ (single-phase perovskite), $(La_xSr_{1-x})_3(Fe_{1-y}Co_y)_2O_{7-\delta}$ (Ruddlesden-Popper phase), $Ba(Ce,Zr,Y)O_{3-\delta}$ (proton conductor) systems will be discussed.

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