

Defect chemistry and transport properties of 'Simple' and 'complex' oxide functional materials

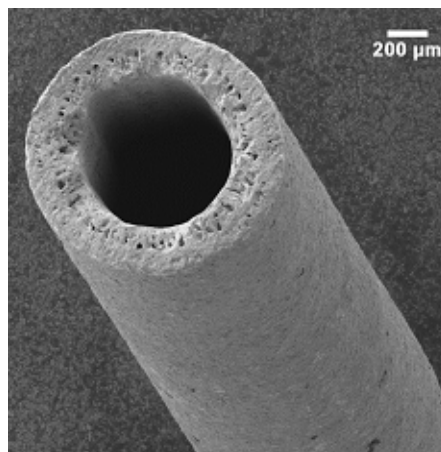
M. Schroeder, Institute of Physical Chemistry, RWTH Aachen, Germany

Metal oxides play an increasingly important role in technology as they are materials that can accomplish specific functions in various applications. Examples are electroceramics, ionically conducting oxides for fuel cells, sensors and membranes, superconductors, and catalytically active oxides, to name but a few. The chemical and transport properties of these oxides are in general dependent on a variety of factors such as temperature, chemical composition, crystal structure, and others. Sometimes, metal oxides are termed 'simple' if they contain only a single cation sublattice, and 'complex' if they contain more than one cation sublattice.

The physicochemical properties of 'simple oxides' are all but simple, however, 'complex oxides' often show a larger variation of their properties even if they crystallize in the same crystal structure. This may be illustrated by the perovskite structure, where a variation of the chemical composition produces materials with predominantly ionic conduction as well as predominantly electronic conductors and mixed ionic electronic conductors (MIEC).

The behaviour of metal oxides is largely determined by their defect chemistry, and a detailed knowledge of the nature of structural and electronic defects provides us not only with a means to understand the oxide properties, but also to control and modify these properties.

During the talk, a number of selected 'simple' and 'complex' oxide functional materials will be discussed as well as combinations of both. The importance of lattice and electronic defects for the transport properties will be highlighted. Possible uses in (mostly high temperature) applications, such as fuel cells and ceramic membranes (Figure), are presented.



Micrograph of a tubular metal oxide membrane designed for separation of oxygen from air