# IONIC AND MIXED CONDUCTING CERIA-METAL (OXIDE) COMPOSITES: MATERIALS AND APPLICATIONS

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Ceria-metal ceramic composites were prepared. Ionic and mixed electron/ion conduction can be controlled through compositions and heat-treatment. There existed two thresholds of the metal contents for ionic and percolative electronic dominating conduction in these ceria-metal (oxide) composites. Under the ionic threshold, the ceria-metal- composites exhibited a pure ionic conducting property in oxygen atmosphere; above the ionic threshold, the composite showed a mixed conduction; while at the percolative threshold the composite displayed a conductivity peak but mainly as the electronic conduction. For higher metal compositions the metal particles can form percolative metal phase thus to cause mainly electron conduction from the metal phase incorporated by some ion conduction from the ceria phase. Significant improvement in oxygen ion conduction and transport were observed for these composites compared to the pure ceria material. The materials were used as electrolytes with successful function for intermediate temperature solid oxide fuel cells (ITSOFCs), exhibiting much better fuel cell performances than that using the pure ceria electrolytes. Further composed with a proton conducting inorganic salt phase, e.g., MOH (M = K, Na) the GCO-Ni-Al-MOH composites showed an extraordinary high fuel cell performance between 400 and 600 °C. In addition, the electronic conducting composites were also studied for fuel cell electrodes.