# Chemical Sensing and Peculiar Redox Properties of Calcium Barium Cobalt Oxide Thin Films as a Viable Cathode Material for Solid Oxide Fuel Cells

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Solid oxide fuel cells require pure electronic conductors with composite designs and high operating temperatures. In this respect, mixed ionic electronic conductors are desirable due to their ability to catalyze oxygen dissociation at intermediate temperatures. The purpose of this experiment was to analyze the properties of a synthesized perovskite oxide thin film, CaBaCo2O5+d (CBCO) because of its epitaxial compatibility with LaAlO3 (LAO) laser deposition, and possible oxygen vacancies in its structure. CBCO was grown on LAO substrates using pulsed laser deposition. The thin film was placed within a lab furnace, set to temperatures up to 970K. Chemical sensing and redox properties were measured using an AC bridge system under chemical environments of hydrogen (HN mixture) and oxygen. The resistance (dependent variable) was measured over about 6 hour periods of time. It was found that CBCO was sensitive to redox atmospheres as low as 620K. As the gas flow was switched from O to HN mixture, the resistance increased with time to its maximum value 1.6 x10^7 ?, then decreased at a rate of 4.0 x10^6 ?/s. The gas flow was switched back to oxygen, and the resistance was found to increase then decrease with similar rate change. The temperature was raised up to 970K following increments of 620K, 720K, 770K, 820K, and 920K. The maximum resistance change was recorded at 7.1x10^6 ?/s. The thin film was found to be sensitive to oxidizing/reducing environments at medium high temperatures, and cobalt ion stability was shown to occur after 770K. Plenty of oxygen vacancies formed in the thin film and caused superfast oxidation rates and resistance changes, displaying CBCO's viability as a mixed ionic electronic conductor.