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Thermogravimetric, Calorimetric, and Structural Studies of the Co3O4/CoO Oxidation/Reduction Reaction KARL UNRUH, RONALD CICHOCKI, BRIAN KELLY, GERALD POIRIER, Univ of Delaware — To better assess the potential of cobalt oxide for thermal energy storage (TES), the Co3O4/CoO oxidation/reduction reaction has been studied by thermogravimetric (TGA), calorimetric (DSC), and x-ray diffraction (XRD) measurements in N2 and atmospheric air environments. TGA measurements showed an abrupt mass loss of about 6.6% in both N2 and air, consistent with the stoichiometric reduction of Co3O4 to CoO and structural measurements. The onset temperature of the reduction of Co3O4 in air was only weakly dependent on the sample heating rate and occurred at about 910 °C. The onset temperature for the oxidation of CoO varied between about 850 and 875 °C for cooling rates between 1 and 20 °C/min, but complete re-conversion to Co3O4 could only be achieved at the slowest cooling rates. Due to the dependence of the rate constant on the oxygen partial pressure, the oxidation of Co3O4 in a N2 environment occurred at temperatures between about 775 and 825 °C for heating rates between 1 and 20 °C/min and no subsequent re-oxidation of the reduced Co3O4 was observed on cooling to room temperature. In conjunction with a measured transition heat of about 600 J/g of Co3O4, these measurements indicate that cobalt oxide is a viable TES material.

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