Solid state electrochemical characterization of phase equilibrium in the system NaNbO3+ Na2Nb4O11

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Abstract

The electrochemical characterization of thermodynamic properties of the phase mixture (NaNbO3+ Na2Nb4O11) has been investigated by using the galvanic cell:

Pt, CO2,O2 —Na2CO3(Au)—(NaNbO3+ Na2Nb4O11)(Au)—YSZ— O2,Pt (I).

Na2CO3 pellet together with NaNbO3+ Na2Nb4O11 pellet serves as measuring electrode. The cell voltage is measured as a function of the sodium activity by varying the gas composition of the measuring electrode of cell (I) at different temperatures. The electrode materials (NaNbO3+ Na2Nb4O11) were prepared by solid state reaction and characterized by XRD, DTA, and chemical analysis. Depending on the sodium activity of measuring electrode, phase equilibrium (2NaNbO3 Na2O+ Na2Nb4O11) is found to be shifted either to left or to right. Thus, one phase is formed at the expense of other or vice versa. In this way, the phase equilibrium has been characterized in terms of the equilibration time, the reversibility and the temperature dependence. The sodium oxide activity of the system can be determined as a function of temperature by the following equation: lgaNa2O = -2.999-(10754/T(K)) (673-848 K). Taking into account of other information from the literature, this technique allows to determine the standard Gibbs free energy of formation (deltaG) of the composition Na2Nb4O11: (deltaG)=-4640.9+ (2.233)T kJ/mol (673 - 848 K). It is not possible to compare the obtained data due to the paucity of information in the literature.