

phase limits are from  $\text{Sn}_{0.04}\text{WO}_3$  to  $\text{Sn}_{0.06}\text{WO}_3$ . Two orthorhombic II bronze phases form, one at a composition of  $\text{Sn}_{0.13}\text{WO}_3$  to  $\text{Sn}_{0.15}\text{WO}_3$ , and another at  $\text{Sn}_{0.16}\text{WO}_3$ . These bronzes have structures which consist of lamellae of  $\text{WO}_3$  united by fault planes. The other bronze phase to form, with the tetragonal tungsten bronze structure, has a lower composition limit of  $\text{Sn}_{0.21}\text{WO}_3$ .

*Thermodynamics of Double Oxides. II. Study of the CoO-TiO<sub>2</sub> System by the Electromotive Force Method.* S. G. POPOV AND V. A. LEVITSKII, Laboratory of Chemical Thermodynamics, Moscow State University, Moscow, 117234, USSR. The emf method using an oxide-ion-conducting electrolyte has been used to determine the thermodynamic properties of CoO-TiO<sub>2</sub> system in the temperature range 1160–1420°C. Electrochemical reduction and oxidation of the electrodes showed that the compositional boundary for  $\text{CoTiO}_{3-\gamma}$  is near the composition  $\text{CoTiO}_{2.85}$ . Standard values of  $\Delta H^\circ$  and  $\Delta G^\circ$  of formation of  $\text{CoTiO}_3$  and  $\text{Co}_2\text{TiO}_4$  from oxides and elements, as well as entropies for these compounds, are presented and compared with the literature data. The discrepancy in  $\Delta H^\circ$  values of formation from oxides for some spinels obtained from emf and gas equilibrium data and by high-temperature solution calorimetry is discussed.

*Growth of Single-Phase, Single Crystals of V<sub>9</sub>O<sub>17</sub>.* H. KUWAMOTO, N. OTSUKA, AND H. SATO, School of Materials Engineering, Purdue University, West Lafayette, Indiana 47907. Single crystals of Magnéli phase  $\text{V}_9\text{O}_{17}$  were successfully grown for the first time by a vapor transport technique utilizing  $\text{TeCl}_4$  as a transport agent. No trace of syntactically intergrown  $\text{V}_8\text{O}_{15}$  could be detected in these crystals. The structure is triclinic and is homologous to other Magnéli phase compounds  $\text{V}_n\text{O}_{2n-1}$  ( $n = 3-8$ ). The lattice parameters (of the reduced cell) measured are  $a = 7.009 \text{ \AA}$ ,  $b = 14.518 \text{ \AA}$ ,  $c = 5.418 \text{ \AA}$ ,  $\alpha = 95.5^\circ$ ,  $\beta = 108.9^\circ$ ,  $\gamma = 83.1^\circ$ . This compound manifests a metal-insulator transition as in other Magnéli phase compounds. The transition temperature has been determined to be 79 K. At or below the transition point down to 16 K, at which an anomalous peak in the resistivity exists, a time dependence of resistivity at fixed temperatures is found. The existence of  $\text{V}_{10}\text{O}_{19}$  was also confirmed by transmission electron microscopy in a material produced under highly nonequilibrium conditions, intergrown in the matrix of  $\text{V}_9\text{O}_{17}$  in a microsyntactic fashion. The existence of  $\text{V}_{10}\text{O}_{19}$  has never been reported.

*The Structure of LaTaO<sub>4</sub> at 300°C by Neutron Powder Profile Analysis.* R. J. CAVA AND R. S. ROTH, Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974.  $\text{LaTaO}_4$  above 175°C is orthorhombic, space group  $A2_1am$ , with  $a = 5.6643(1)$ ,  $b = 14.6411(3)$ ,  $c = 3.9457(1)$ , and  $z = 4$ . It is isostructural with room temperature  $\text{BaMnF}_4$ . The structure, refined by the Rietveld powder profile analysis technique to a final agreement index of 8.6%, consists of sheets of corner-shared  $\text{TaO}_6$  octahedra extending perpendicular to  $b$ , bonded to each other parallel to  $b$  by the 9-coordinated lanthanum ions. All atoms are in position  $(x, y, 0)$  with coordinates: La(.1788, .1676), Ta(.2192, .4141), O1(.4216, .3008), O2(-.0486, .3380), O3(.5614, .4689), O4(.2496, .9153). Orthorhombic  $\text{CeTaO}_4$  and  $\text{PrTaO}_4$  are isostructural.

*The Crystal of Lu<sub>3</sub>S<sub>4</sub>: A New Population Wave Structure.* A. V. HARIHARAN, D. R. POWELL, R. A. JACOBSON, AND H. F. FRANZEN, Ames Laboratory-DOE and Department of Chemistry, Iowa State University, Ames, Iowa 50011. The monosulfide of lutetium loses lutetium preferentially upon vaporization *in vacuo* at 1750°C, and the quenched samples exhibit a new structure which is formed by an ordering of metal vacancies on the rock-salt type of lattice.

*Structure cristalline de K<sub>2</sub>SO<sub>4</sub>(SbF<sub>3</sub>)<sub>2</sub>.* MARIE BOURGAULT, BERNARD DUCOURANT, BERNARD BONNET, AND ROBERT FOURCADE, Laboratoire de Chimie Minérale D, Université des Sciences et Techniques du Languedoc, Place Eugène Bataillon, 34060 Montpellier Cédex, France. The crystal structure of  $\text{K}_2\text{SO}_4(\text{SbF}_3)_2$  was determined by X-ray diffraction on a single crystal ( $R = 0.035$  for 2264 reflections). There are two families of antimony atoms showing two different environments:  $\text{AX}_5\text{E}$  octahedron (6-coordination) and  $\text{AX}_6\text{E}$  3.3.1 monocapped octahedron (7-coordination). The  $\text{SO}_4^{2-}$  unit weakly bonded to four antimony atoms is not much distorted. This arrangement permits the minimization of  $\pi$ -E interactions. Infrared and Raman spectra are discussed in terms of diffraction results.

*The Crystal Structure of Mg<sub>51</sub>Zn<sub>20</sub>.* IWAMI HIGASHI, NOBUHIRO SHIOTANI, M. UDA, TADASHI MIZOGUCHI, AND HIROAKI KATOH, The Institute of Physical and Chemical Research, Wako-Shi,