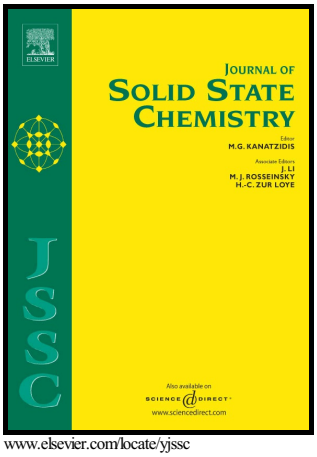
Author's Accepted Manuscript



www.elsevier.com/locate/yjssc

A facile pathway to prepare VO_2 and V_2O_3 powders via a carbothermal reduction process

Yue-Dong Wu, Guo-Hua Zhang, Yu Wang, Rui Xu, Kuo-Chih Chou

PII: S0022-4596(18)30257-3
DOI: https://doi.org/10.1016/j.jssc.2018.06.016
Reference: YJSSC20263

To appear in: *Journal of Solid State Chemistry*

Received date: 5 February 2018
Revised date: 5 June 2018
Accepted date: 15 June 2018

Cite this article as: Yue-Dong Wu, Guo-Hua Zhang, Yu Wang, Rui Xu and Kuo-Chih Chou, A facile pathway to prepare VO_2 and V_2O_3 powders via a carbothermal reduction process, *Journal of Solid State Chemistry,* https://doi.org/10.1016/j.jssc.2018.06.016

A facile pathway to prepare VO_2 and V_2O_3 powders via a carbothermal reduction process

Yue-Dong Wu, Guo-Hua Zhang*, Yu Wang, Rui Xu, Kuo-Chih Chou

State Key Laboratory of Advanced Metallurgy, University of Science and Technology Beijing, Beijing 100083, China.

*Corresponding author: Guo-Hua Zhang; contact email: ghzhang_ustb@163.com; fax: 86-10-62332252; telephone: 86-10-82377750; address: Xue-Yuan Road 30, Hai-Dian District, Beijing 100083, China

Abstract

The development of a highly efficient and low cost production process is instrumental for the wide application of VO_2 and V_2O_3. In this paper, VO_2 and V_2O_3 powders are successfully prepared via carbothermal reduction of V_2O_5 in a flowing Ar atmosphere at 973 K and 1423 K, respectively. Compared with the traditional methods, graphite is used as a reductant, which resulted in a low cost. The experimental results show that a high temperature assists in improving the kinetic rate. The phase transformation during the low-temperature reduction process between 948 K and 973 K occurs in the following sequential order : $V_2O_5 \rightarrow V_6O_{13} \rightarrow VO_2$. When the temperature is 1423 K or 1473 K, the phase transformation can be described as follows: $V_2O_5 \rightarrow V_3O_5 \rightarrow V_2O_3$. Owing to the shrink of the volume, the as-prepared VO_2 and V_2O_3 particles could not maintain the original micro-morphology of V_2O_5. Relative to VO_2, the as-prepared V_2O_3 particles are porous. It is also concluded that the V_2O_3 can be easily oxidized to VO_2, when the partial pressure of O_2 is in the range of 10^{-8} atm to 10^{-1} atm. Therefore, a reasonable reaction temperature and reaction time are important to prepare high purity V_2O_3.

Graphical abstract

* Author to whom correspondence should be addressed e-mail: ghzhang_ustb@163.com