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A facile pathway to prepare VO₂ and V₂O₃ powders via a carbothermal reduction process

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Abstract

The development of a highly efficient and low cost production process is instrumental for the wide application of VO₂ and V₂O₃. In this paper, VO₂ and V₂O₃ powders are successfully prepared via carbothermal reduction of V₂O₅ 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 : V₂O₅ → V₆O₁₃ → VO₂. When the temperature is 1423 K or 1473 K, the phase transformation can be described as follows: V₂O₅ → V₃O₅ → V₂O₃. Owing to the shrink of the volume, the as-prepared VO₂ and V₂O₃ particles could not maintain the original micro-morphology of V₂O₅. Relative to VO₂, the as-prepared V₂O₃ particles are porous. It is also concluded that the V₂O₃ can be easily oxidized to VO₂, when the partial pressure of O₂ 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 V₂O₃.

Graphical abstract

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