ORIGINAL PAPER

Synthesis and structural characterization of YVO3

prepared by sol–gel acrylamide polymerization

and solid state reaction methods

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Abstract The formation of the YVO3 compound

obtained by sol–gel acrylamide polymerization is reported.

This synthesis method is contrasted with solid state reaction.

Differential thermal analysis (DTA) results show the

formation of YVO3 at 805 \_C compared with 1312 \_C for

solid state reaction. Thermogravimetric analysis (TG)

results show that between 400 and 600 \_C the denaturalization

of the organic part, ethylenediamine, and the

decomposition of nitrates occur. The evolution of YVO4

into YVO3 was also studied by X-ray powder diffraction

(XRD). The refinement results obtained for both YVO3

samples show an orthorhombic phase with Pbnm (62)

space group and lattice parameters: a = 5.283 A ° ,

b = 5.605 A ° and c = 7.580 A ° . Grain size and morphology

evolution for different heat treatments were studied with

scanning electron microscopy (SEM). The use of sol–gel

acrylamide synthesis allows us to start with a homogeneous

grain distribution with a mean size of 5.03 ± 0.65 nm

growing up to 4.11 ± 0.87 lm in YVO4. After reduction to

YVO3 the final grain size was 2.87 ± 0.10 lm also with

grain size homogeneity. This is in contrast with samples

prepared by solid state reaction for which the grain size

starts (YVO4) between 1 and 7.0 lm and ends (YVO3)

with a size distribution centered at 90.32 ± 74.46 lm.

Transmission electron microscopy (TEM) results corroborate

XRD results. Energy dispersive X-ray (EDX) results

are in agreement with theoretical values.

Keywords Ceramics \_ Crystal growth \_

Electron microscopy (TEM, SEM) \_ Nanomaterials

1 Introduction

Electronic properties of transition metal oxide compounds

with strong electron-electron correlations have attracted

attention since the advent of high-Tc superconductors.

Recently, the perovskite YVO3 has been studied intensively

as an example of a Mott transition system. It is of

the great importance to clarify the physical properties of

the Mott-Hubbard insulator YVO3 compound for which the

spin, charge and orbital ordering are still unexplained, with

a lack of consensus on their microscopic origin [1–9].

The YVO3 compound presents the perovskite structure

of GdFeO3 with an orthorhombic phase, Pbnm space group

and well determined unit cell parameters [10–14]. Due to

the distorted perovskite structure this compound exhibits

interesting physical properties and wide range of possibilities

for practical applications in electronic devices.

The research into electronic properties of this compound

requires very pure materials in order to optimize its

particular properties. The most commonly used method is

solid state reaction. However, this method has clear disadvantages.

For example, uncontrolled crystalline growth

occurs, ending in grain-size non-uniformity. For YVO3

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