Synthesis and characterization of nanoparticles $Zn_{1-x}M_xWO_4$ obtained via hydrothermal microwave route

Carla J. Santos[1] (PG), Francisco M. Filho[1*] (PQ)

[1]*Federal University of Itajubá*

**franciscomoura@unifei.edu.br*

Keywords: *$ZnWO_4$, nanoparticles, microwave.*

Abstract

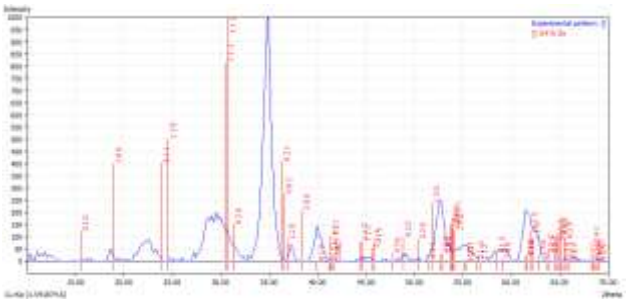
This study is a framework proposal for understanding the effect of time and temperature at $ZnWO_4$ nanocrystals synthesized using a microwave hydrothermal method. These samples were characterized by X-ray diffraction, thermogravimetric analyses, infrared spectroscopy and scanning electron microscopy.

Introduction

Metalics tungstates with the formula AWO_4 are awakening interest in different fields of knowledge due to their structure and their physical and chemical properties. $ZnWO_4$ shares with a tungstates group of divalent transition metal ion radius ≤0,77Å and general formula AWO_4 (A = Fe, Mn, Co, Ni, Mg, Zn) of the crystal structure wolframite type with space group P2/c and two units in each formula unit cell[1]. Particularly, zinc tungstate ($ZnWO_4$) is a technologically important material which can be used in various applications, such as scintillators, laser hosts, optical fibres, sensors and phase-change optical recording. Up till now, several methods have been developed to synthesize nanocrystalline $ZnWO_4$, including Czochralski technique, sol-gel technique, hydrothermal process, aqueous solution growth, polymerized complex method, hydrothermal combined with annealing treatment, template method, novel solid-state metathetic approach, self-propagating combustion method and so on[2]. Recently, microwave irradiation has been applied for the fast synthesis of inorganic and organic solids. The microwave assisted hydrothermal synthesis, for example, employed for the synthesis of nanoparticles, presents a series of advantages when compared to other methods.It is an inexpensive, facile and quick method to synthesize nanocrystalline samples and the several studies on the microwave-assisted synthesis have been revealed that the kinetics of the organic and inorganic chemical reactions can be accelerated significantly by microwave radiations[3]. However, the synthesis of $Zn_{1-x}M_xWO_4$ nanoparticles using this technique, is being held at high temperatures and long periods of time. Thus, the development of this work is based on the need to reduce the time and temperature synthesis $Zn_{1-x}M_xWO_4$ and production of nanoparticles with shape, size and state of well-defined disintegration.

Results and discussion

Figure 1. The XRD spectra $ZnWO_4$, prepared at 120°C / 60 min.



Conclusions

The synthesis of $Zn_{1-x}M_xWO_4$ by hydrothermal method assisted by microwave been shown to be effective for obtaining crystalline nanoparticles in shorter times and temperatures.

Acknowledgements

Fapemig.
Prof. Dr. Francisco Moura Filho.
Prof. Dr. Daniel Cristian Ferreira Soares.
Interdisciplinary Laboratory for Advanced Materials.
Federal University of Itajubá.
Graduate Multicenter Program in Chemistry of Minas Gerais.
Rede Mineira de Química.
Chemistry Department, Federal University of Minas Gerais.

[1] Daturi, M.; Borel, M. M.; Leclaire, A.; Savary, L.; Costentin, G.; Lavalley J. C. *J. Chem. Phys.* **1996**, 93, 2043.

[2] Rahimi-Nasrabadi, M.; Pourmortazavi, S. M.; Ganjali, M. R.; Hajimirsadeghi, S. S.; Zahedi, M. M. *J. Mol. Struc.* **2013**, *1047*, 31.

[3] Oghbaei, M.; Mirzaee, O. *J. All.Comp.* **2010**, *494*, 175.