11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

STUDY OF CRYSTAL STRUCTURE, MORPHOLOGY AND COMPOSITION OF THE α-MoO_3 DOPED WITH NEODYMIUM, OBTAINED BY THERMAL PRECIPITATION.

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Abstract

Molybdenum trioxide is a material with chromogenic properties, i.e. its optical properties change in accordance with the impinging radiation, which has led to technological applications such as optical units for massive storage of information, thank mainly to its capability to switch between two optical states [1]; furthermore, the development of thin film devices based on MoO_3 has allowed its application as gas sensors [2], smart windows [3], moreover, the scientific community's attention has been aimed as well on the development of solid state micro batteries in which the MoO_3 is used as cathode material and Li ions move through channels in the α-MoO_3 structure.

Compounds of α-MoO_3 Nd doped from powder samples at concentrations of (0.2%, 1.0%, 5.0%, 10.0% and 20% %at) were developed by thermal precipitation in order to fabricate materials with optoelectronic properties such as photoluminescence emission in the visible and infrared spectrum. Sample preparation was carried out from a solid phase reaction of α-MoO_3 and Nd_2O_3 in an isopropanol solution, stirred permanently for 8 hours at 298°K and then dried up for 8 hours at 353°K; the final stage to obtain the compounds was performed through a calcination process at 823°K for 20 hours.

The behavior of the lattice parameters as a function of temperature as well as the evaluation of thermal dilation coefficients were studied through X-Ray Diffraction as a function of temperature in steps of 323°K up to the final 823°K; growth directions and crystallographic orientations of doped and non doped materials were evaluated by (TEM). The study of the morphology and particle size was performed through (SEM); the chemical composition of the oxides obtained was carried out by scattered electron spectroscopy (EDX).XRD results allowed establishing the behavior of the thermal dilation coefficients (α_c), α-MoO_3 and obtained oxides lattice parameters, which showed a 2% variation; it is important to point out that the α_c variation of the c lattice parameter presents a negative value. TEM studies (fig. 2) have helped establishing that both growth directions and plane families, found through XRD, agree with each other. On the other hand, SEM study has shown that the doped and non doped materials' morphologies are not markedly different. Finally, EDS studies have shown that the Nd composition (%at) in the doped α-MoO_3 do not present a tendency with the rising Nd concentration.

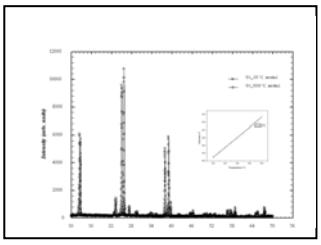

Figure 1: XRD pattern for samples with 5% of Neodymium at 323 K and 823 K. The unset square shows the curve fitting for the b lattice parameter.

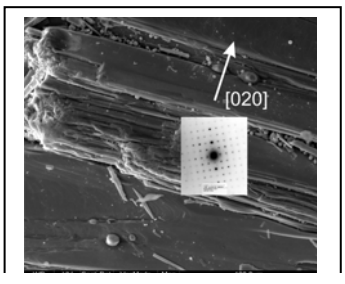

Figure 2: Electron pattern diffraction and micrograph SEM for the α-MoO3 doped with 5% neodymium.

References

[1] N. Miyata, S. Akiyoshi, J. Appl. Phys. 58(1985)1651.
[2] A. Larrubia, G. Ramis, G. Busca. Appl. Cat. B Eenviron 27(2000) L145.
[3] M. Ferroni V. Guidi, G. Martinelli. Thin Solid Films 307(1997) 148-151..