Accepted Manuscript

Structural evolution and dielectric properties of Nd and Mn co-doped BaTiO₃ ceramics

Qiaoli Liu, Junwei Liu, Dayong Lu, Weitao Zheng, Chaoguan Hu

PII: S0925-8388(18)31774-2

DOI: 10.1016/j.jallcom.2018.05.089

Reference: JALCOM 46062

To appear in: Journal of Alloys and Compounds

Received Date: 1 January 2018

Revised Date: 5 May 2018 Accepted Date: 7 May 2018

Please cite this article as: Q. Liu, J. Liu, D. Lu, W. Zheng, C. Hu, Structural evolution and dielectric properties of Nd and Mn co-doped BaTiO₃ ceramics, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.05.089.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Journal of Alloys and Compounds

Structural evolution and dielectric properties of Nd and Mn

co-doped BaTiO₃ ceramics

Qiaoli Liu^{a, b}, Junwei Liu^b, Dayong Lu^{b, **}, Weitao Zheng^{a, *}, Chaoquan Hu^a

^a School of Materials Science and Engineering, Key Laboratory of Mobile Materials, MOE, and State Key Laboratory of

Superhard Materials, Jilin University, Changchun 130012, China

^b Research Center for Materials Science and Engineering, Jilin Institute of Chemical Technology, Jilin 132022, China

ABSTRACT

 $(Ba_{1-x}Nd_x)(Ti_{0.97}Mn_{0.03})O_3$ (BNTM) (x = 0.01, 0.02, 0.04, 0.06) ceramics were prepared using a conventional cold-pressing

ceramic technique. The structure, valence state and dielectric properties were investigated using XRD, RS, SEM, TEM, EPR,

and dielectric temperature and frequency measurements. XRD, RS analysis coupled with SEM and TEM observations

indicate that the samples have a coexistence of tetragonal and hexagonal phase at room temperature as $x \le 0.02$ and become a

single phase in the tetragonal as x = 0.04 and in the cubic as x = 0.06 (air-sintered, 1400 °C/12 h). It reveals that Nd³⁺ ions can

suppress hexagonal phase effectively and benefit the formation of single-phase ceramics. Improvement of dielectric

properties is accompanied by the structural evolution. Particularly a cubic ceramic with x = 0.06, the dielectric-peak

temperature is found to shift to room temperature, meeting the EIA Y5V specification with tan $\delta < 0.04$. Up to x = 0.04, the

phase transition remains first order. The valence state of Mn ions was analyzed by EPR. It is found that Mn ions transform

from high valence (+3 and +4) to low valence (+2) with the increase of Nd concentration, and all of the Mn ions exist as

 $\mathrm{Mn^{2+}}$ when x = 0.06. The unit cell volume and dielectric-peak temperature of BNTM decrease nonlinearly with increasing x,

which can be ascribed to the incorporation of Nd ions and the formation of $2Nd_{Ba}^{\bullet} - Mn_{Ti}^{\bullet}$ donor-acceptor defect complexes.

Key-words: BaTiO₃; Structural evolution; Valence state; Defect complexes; Dielectric properties; Electron paramagnetic

resonance

* Corresponding author

E-mail addresses: wtzheng@jlu.edu.cn (W.-T. Zheng), cninjp11232000@yahoo.com (D.-Y. Lu).

1

Download English Version:

https://daneshyari.com/en/article/7991019

Download Persian Version:

https://daneshyari.com/article/7991019

<u>Daneshyari.com</u>