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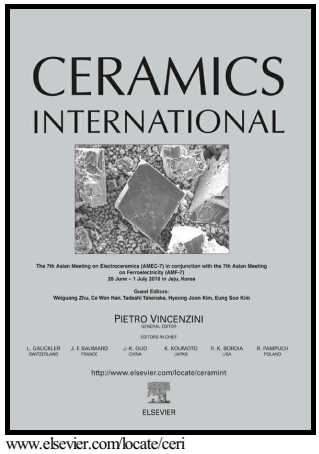

www.elsevier.com/locate/ceri

PII: S0272-8842(18)30125-1
DOI: https://doi.org/10.1016/j.ceramint.2018.01.118
Reference: CERI17250

To appear in: *Ceramics International*

Received date: 3 November 2017
Revised date: 28 December 2017
Accepted date: 14 January 2018

Cite this article as: Yuanyuan Lv, Zhiyong Zhang, Junfeng Yan, Wu Zhao and Chunxue Zhai, Al doping influences on fabricating ZnO Nanowire Arrays: Enhanced Field Emission Property, *Ceramics International,* https://doi.org/10.1016/j.ceramint.2018.01.118

Al doping influences on fabricating ZnO Nanowire Arrays: Enhanced Field Emission Property

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Abstract: Increase of free electrons concentration and decrease of defects density are the most desirable solution for stimulating the field emission property in semiconductor nanostructures. To implement this, herein we study the field emission efficiency of Al-doped ZnO nanowire arrays with different Al doping concentration, which were prepared by a simple facile hydrothermal method. The Al doping concentration plays a very important role on the structure, morphology, photoluminescence and field emission properties of the as-assembled samples. The results indicate that Al-doped ZnO nanowire arrays with Al doping concentration of 7 at.% exhibit the highest quality crystalline structure and lowest defect density relative to others samples thanks to the suitable modification of Al doping, and this led to the increase of free electrons concentration and decrease of defects density, which have an excellent field emission performance with the lower turn on field of 1.03 V/μm and higher field enhancement factor of 20658. This remarkable field emission performances of the Al-doped ZnO nanowire arrays may provide promising applications for different field emission devices.

Keywords: ZnO Nanowire Arrays; Al doping; crystalline structure; Free electrons concentration; Defects; Field Emission

1. Introduce

Field emission, also known as field electron emission, rather than thermionic, photoelectric, or secondary emission, is a process associated with quantum tunneling, in which electrons below or close to the emitter Fermi level with the aid of an external electric field escape from the materials surface by tunneling through surface barrier[1, 2]. Field emission has increasingly attracted research attention for its importance in both fundamental research and high power device applications[3, 4], such as flat panel displays, vacuum micro- or nano-electronic devices involved in the fields of consumer goods, and X-ray generators. Among the several types of field emitters, One-dimensional (1D) field emitters with different