# Accepted Manuscript


Effects of He ion irradiation on the microstructures and mechanical properties of t' phase yttria-stabilized zirconia ceramics

Guo Pu, Jianxiong Zou, Liwei Lin, Kun Zhang, Bo Liu, Fei Ma, Qiangbing Wang, Qiran Li

PII: S0925-8388(18)33150-5

DOI: 10.1016/j.jallcom.2018.08.259

Reference: JALCOM 47347

To appear in: *Journal of Alloys and Compounds*

Received Date: 21 June 2018

Revised Date: 26 August 2018

Accepted Date: 27 August 2018

Please cite this article as: G. Pu, J. Zou, L. Lin, K. Zhang, B. Liu, F. Ma, Q. Wang, Q. Li, Effects of He ion irradiation on the microstructures and mechanical properties of t' phase yttria-stabilized zirconia ceramics, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.08.259.

# Effects of He ion irradiation on the microstructures and mechanical properties of t' phase yttria-stabilized zirconia ceramics

*Guo Pu[1], Jianxiong Zou[1], Liwei Lin[1], kun Zhang[1] Bo Liu[1*], Fei Ma[2], Qiangbing Wang[3], Qiran Li[4]*

*[1]Key Laboratory of Radiation Physics and Technology of Ministry of Education, Institute of Nuclear Science and Technology, Sichuan University, Chengdu 610064, China;*

*[2]State-key Laboratory for Mechanical Behavior of Materials, Xi'an Jiaotong University, Xi'an 710049, China;*

*[3]State Key Laboratory of Porous Metal Materials, Northwest Institute for Nonferrous Metal Research, Xi'an, China;*

*[4]INNOVICES SARL, 1 Place Paul Verlaine, 92100 Boulogne Billancourt, France*

*E-mail: liubo2009@scu.edu.cn*

**Abstract**

The dense $ZrO_2$-8 wt.% $Y_2O_3$ ceramics with tetragonal (t') phase were prepared by spark plasma sintering (SPS). The micro-structure modification in poly-crystalline t' phase YSZ ceramics irradiated with 60 KeV He ions over a wide fluence range were studied. It is found that, the t' → t + c phase transformation was detected for the samples irradiated at the fluence above $2\times10^{17}$ $cm^{-2}$. In addition, a three-steep model for damage stages has been proposed and discussed for interpreting the evolution of mechanical properties of t'-YSZ ceramics after irradiated, mainly revealed by the analysis from HRTEM results. Firstly, as the $He^+$ fluences range from $0.5\times10^{17}$ $cm^{-2}$ to $1\times10^{17}$ $cm^{-2}$, the hardening effects were confirmed in t'-YSZ owing to the irradiation induced defects serve as obstacles to resist slipping of dislocations. As the fluence was increased to $2\times10^{17}$ $cm^{-2}$, the degradation of mechanical properties was evidenced, which could be ascribed to the deterioration effect of aggregated He bubbles inside t' YSZ grains. While the fluence increased to $10\times10^{17}$ $cm^{-2}$, a seriously damaged region was approximately located at 250 nm in depth, at which a great