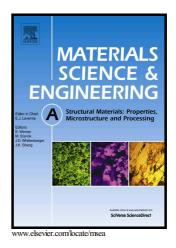
Author's Accepted Manuscript

Investigation on mechanical properties and microstructure of silicon nitride ceramics fabricated by spark plasma sintering

Liyan Cao, Zhenhua Wang, Zengbin Yin, Kui Liu, Juntang Yuan



PII:S0921-5093(18)30896-7DOI:https://doi.org/10.1016/j.msea.2018.06.093Reference:MSA36648

To appear in: Materials Science & Engineering A

Received date:26 April 2018Revised date:22 June 2018Accepted date:23 June 2018

Cite this article as: Liyan Cao, Zhenhua Wang, Zengbin Yin, Kui Liu and Juntang Yuan, Investigation on mechanical properties and microstructure of silicon nitride ceramics fabricated by spark plasma sintering, *Materials Science & Engineering A*, https://doi.org/10.1016/j.msea.2018.06.093

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 galley proof before it is published in its final citable 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.

ACCEPTED MANUSCRIPT

Investigation on mechanical properties and microstructure of silicon

nitride ceramics fabricated by spark plasma sintering

Liyan Cao^{a,b}, Zhenhua Wang^{a,b,*}, Zengbin Yin^{a,b}, Kui Liu^{a,b}, Juntang Yuan^{a,b}

^a Nanjing University of Science & Technology, School of Mechanical Engineering, Nanjing 210094, PR China

^b Collaborative Innovation Center of High-End Equipment Manufacturing Technology (Nanjing University of Science & Technology), Ministry of Industry and Information Technology, PR China

*Corresponding author. niatwzh17@163.com (Z. Wang)

Abstract:

In order to prepare high-performance and stable performance silicon nitride-based ceramic cutting tools, orthogonal experiment was carried out firstly to study the influence of sintering temperature and sintering aids (MgSiN₂, Y₂O₃ and CeO₂) on the densification and mechanical properties of the Si₃N₄ materials by spark plasma sintering. The results showed that Si_3N_4 ceramics with 5 wt%MgSiN₂, 3 wt%Y₂O₃ and 1 wt%CeO₂ sintering aids had the best relative density and mechanical properties at 1650 °C. Secondly, the effects of sintering temperature on the densification, microstructure and mechanical properties of Si₃N₄ ceramics with 5 wt%MgSiN₂, 3 wt%Y₂O₃ and 1 wt%CeO₂ sintering aids were studied in detail. The results showed that the relative density of Si₃N₄ ceramics reached the maximum of 99.40±0.14% at 1650 °C, the Vickers hardness and fracture toughness were 16.53±0.12 GPa and 6.89 ± 0.20 MPa·m^{1/2}, respectively. The grain shapes were composed of equiaxed α -Si₃N₄ and long columnar β -Si₃N₄, and the transformation rate of α -Si₃N₄ to β -Si₃N₄ was 42.5%. Finally, the statistical distribution of the relative density, phase transformation rate and mechanical properties of Si_3N_4 ceramics with 5 wt%MgSiN₂, 3 wt%Y2O3 and 1 wt%CeO2 sintering aids at 1650 °C was investigated. It was found that the mechanical properties of silicon nitride ceramics sintered by spark plasma sintering were less dispersive, and the hardness and fracture toughness obeyed the two parameters Weibull distribution well.

Download English Version:

https://daneshyari.com/en/article/7971816

Download Persian Version:

https://daneshyari.com/article/7971816

Daneshyari.com