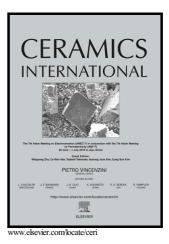
Author's Accepted Manuscript

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 PII:
 S0272-8842(17)31867-9

 DOI:
 http://dx.doi.org/10.1016/j.ceramint.2017.08.194

 Reference:
 CERI16148

To appear in: Ceramics International

Received date:26 July 2017Revised date:9 August 2017Accepted date:25 August 2017

Cite this article as: Qiufa Luo, Jing Lu, Xipeng Xu and Feng Jiang, Removal mechanism of sapphire substrates (0001, 1120 and 1010) in mechanical planarization machining, *Ceramics International*, http://dx.doi.org/10.1016/j.ceramint.2017.08.194

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Removal mechanism of sapphire substrates (0001, 1120 and 1010) in mechanical planarization machining Qiufa Luo^{a,b}, Jing Lu^{a,b,*}, Xipeng Xu^{a,b}, Feng Jiang^{a,b}

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Abstract

The mechanical planarization machining of sapphire substrates including the C-(0001), A- $(11\overline{2}0)$, and M- $(10\overline{1}0)$ orientations with the sol-gel (SG) polishing pad has been performed in this paper. The polishing results show that the C-orientation with a surface roughness about 2 nm is smoother than the A- and M-orientations, and the material removal rate (MRR) of C-orientation is higher than that of them. The removal mechanism of sapphire substrate was investigated by the wear debris and subsurface structure through transmission electron microscopy (TEM). And the instrumented nanomechanical tests were applied to further reveal the removal mechanism by nanoindentation. The analysis results indicate that the variation tendency of MRRs depends on the crystalline structure and nanomechanical properties of sapphire substrates. In addition, the processing of sapphire substrates is mainly dominated by the mechanical removal sapphire material during mechanical

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