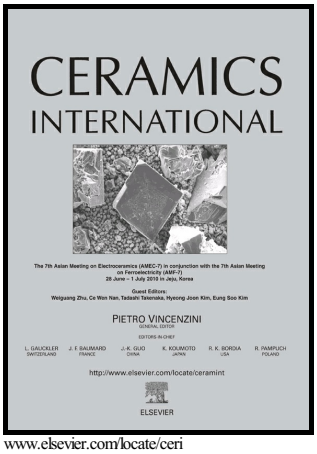
Microstructure evolution of SiC/SiC joints during ultrasonic-assisted air bonding using a Sn–Zn–Al alloy

Bingzhi Wu, Weibing Guo, Jingshan He, Ziyang Xiu, Jiuchun Yan



www.elsevier.com/locate/ceri

PII: S0272-8842(17)31617-6
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.07.169
Reference: CERI15889

To appear in: *Ceramics International*

Received date: 17 June 2017
Revised date: 21 July 2017
Accepted date: 24 July 2017

Cite this article as: Bingzhi Wu, Weibing Guo, Jingshan He, Ziyang Xiu and Jiuchun Yan, Microstructure evolution of SiC/SiC joints during ultrasonic assisted air bonding using a Sn–Zn–Al alloy, *Ceramics International*, http://dx.doi.org/10.1016/j.ceramint.2017.07.169

Microstructure evolution of SiC/SiC joints during ultrasonic-assisted air bonding using a Sn–Zn–Al alloy

Bingzhi Wu, Weibing Guo, Jingshan He, Ziyang Xiu, Jiuchun Yan*
State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin 150001, P.R. China

* Corresponding author. Tel.: +86 451 86418695; fax: +86 451 86416186. E-mail address: jcyan@hit.edu.cn (J.C. Yan).

Abstract

Direct soldering of SiC ceramic in air at 230 °C was achieved using a Sn–9Zn–2Al alloy assisted by ultrasonic wave within seconds. Experimental results indicated that a sound metallurgical bond was formed between the SiC ceramic and Sn–9Zn–2Al alloys. The dependence of interfacial microstructure evolution on ultrasonic action duration time was investigated. Two types of interfacial structures at the interface were observed as the ultrasonic action duration time increased. An amorphous SiO_2 layer was identified at the interface for ultrasonic exposures of 1 s, which was the oxide layer formed on the SiC ceramic surface during heating. A layer of amorphous alumina with a thickness of ~ 6.8 nm formed at the interface under ultrasonic action for over 4 s. The shear strength of joints could reach up to 44 MPa. The formation of the alumina layer at the interface was attributed to the redox reaction of Al from the filler metal and SiO_2 on the SiC ceramic surface under the action of ultrasonic waves. The rapid