SAND2007-2437C

Ultrasonic Imaging and Quantitative Analysis of Defects in Ag-Cu-Zr Active Braze Joints

D.F. Susan, D.R. Garcia, D.B. Appel, S. Younghouse, C.A. Walker, and M. Senkow
Sandia National Laboratories, Albuquerque, NM 87185

Abstract

Active brazing with Ag-Cu-Zr filler metals has been implemented to produce robust ceramic/metal brazements without the need for metallization of the ceramic component. A design of experiments (DOEx) study was performed to assess the process variables involved in active brazing of Al_2O_3 to Kovar™ (low expansion Fe-Ni-Co alloy) to form high-reliability, hermetic joints. Ultrasonic (UT) imaging was used to characterize the joint quality, including porosity content, excess braze flow, and joint underfill. The UT characterization results were confirmed by radiography and metallographic cross-sectioning of the components. The "false color" UT images were quantitatively analyzed using color-based image analysis. This technique was useful for determining the relationships between porosity content, lack of hermeticity, and overall joint quality. The UT results were statistically analyzed to determine the main effects variables in the DOEx, which included brazing furnace atmosphere, filler metal washer thickness, and applied load during brazing. Microstructural analysis of the braze joints revealed porosity characteristics as well as the reaction product between the Ag-Cu-Zr active braze and the Al_2O_3 ceramic. The techniques in this study were also employed to analyze Ag-Cu-Zr braze alloy paste as an alternative to braze washer preforms.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the US Dept. of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.