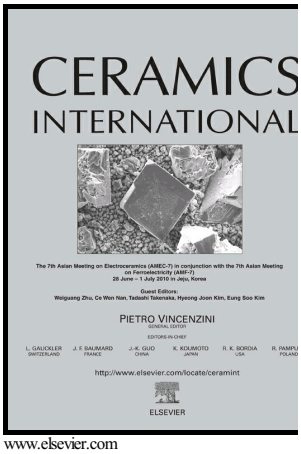

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Design and analysis of the porous ZrO_2/(ZrO_2+Ni) ceramic joint with load bearing-heat insulation integration

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Abstract

The joining of ceramics with metals is widely used in aerospace engineering where high strength and excellent heat insulation materials are desired. In this paper, a new multifunctional bolted joint with load bearing-heat insulation integration is prepared with porous ZrO_2/(ZrO_2+Ni) sandwich ceramics. Double-shear behavior of the bolted joint connecting C/SiC plates is analyzed by ABAQUS codes. It is found that shearing damage occurs at shearing faces of the bolt, the shearing failure faces are layered rather than smooth. To improve its shearing strength, we introduce the shear band (ZrO_2+*V*%Ni of thickness *h*) to its shearing faces. Results show that the shear band can improve the shearing strength and slow down the attenuation of load bearing capacity after reaching the shearing strength, without obviously increasing the thermal conductivity. An optimal structural design is performed and proper shear band is defined to balance the shearing strength and heat insulation performance of the ceramic joint.

Keywords: ZrO_2/(ZrO_2+Ni) sandwich ceramics; Joints/joinging; Mechanical properties; Thermal properties; Finite element analysis

1. Introduction

Thermal Protection System (TPS) is usually covered on the surface of the aircraft as the thermal protecting layer. Owing to the complex shape and structure of the aircraft, a unibody design and manufacture of TPS is infeasible, therefore it is unavoidable to connect lots of thermal protection components. Consequently, heat shorts arising from the gap and joints between thermal protection components cannot be ignored [1]. Heat shorts may lead the interior part of the fuselage structure to an extreme high temperature, severely degrading the heat

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