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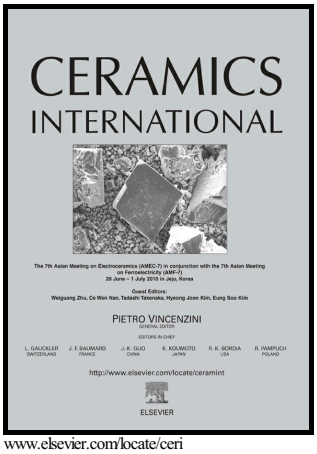

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Infiltration Behavior of Cu and Ti fillers intoTi_2AlC/Ti_3AlC_2 Composites During Tungsten Inert Gas (TIG)Brazing

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Abstract

Herein we study the infiltration behavior of Ti and Cu fillers into a Ti_2AlC/Ti_3AlC_2MAX phase composites using a TIG-brazing process. The microstructures of the interfaces were investigated by scanning electron microscopy and energy dispersive spectrometry. When Ti_2AlC/Ti_3AlC_2 comes into contact with molten Ti, it starts decomposing into TiC_x, a Ti-richandTi_3AlC; when in contact with molten Cu, the resulting phases are $Ti_2Al(Cu)C$, Cu(Al), $AlCu_2Ti$ and TiC. In the presence of Cu at approximately 1630°C, a defective $Ti_2Al(Cu)C$ phase was formed having a P63/mmc structure. Ti_3AlC_2 MAX phase was completely decomposed in presence of Cu or Ti filler-materials. The decomposition of Ti_2AlC to $Ti_3AlC_2$was observed in the heat-affected zone of the composite. Notably, no cracks were observed during TIG-brazing of Ti_2AlC/Ti_3AlC_2 composite with Ti or Cu filler materials.

Keywords: MAX phase; joining; microstructure; hardness; brazing; TIG process.

I. Introduction

The ternary phases Ti_2AlC andTi_3AlC_2 belong to a family of ternary carbides with a general formula$M_{n+1}AX_n$ (MAX), where, M is an early transition metal, A is an A- group element (mostly groups 13 and 14) and X is C or N [1–3]. The MAX phases combine some of the best attributes of metals and ceramics. Like metals, they are electrically and thermally conductive, most readily machinable, not susceptible to thermal shock, plastic at high temperatures, and exceptionally damage tolerant [4]. Ti_2AlC and Ti_3AlC_2 are also creep, fatigue and oxidation resistant, which renders them promising candidates for use in high-temperature structural applications oras conducting ceramics in harsh environments [4,5].

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