

Infiltration behavior of Cu and Ti fillers into $\text{Ti}_2\text{AlC}/\text{Ti}_3\text{AlC}_2$ 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 $\text{Ti}_2\text{AlC}/\text{Ti}_3\text{AlC}_2$ MAX phase composites using a TIG-brazing process. The microstructures of the interfaces were investigated by scanning electron microscopy and energy dispersive spectrometry. When $\text{Ti}_2\text{AlC}/\text{Ti}_3\text{AlC}_2$ comes into contact with molten Ti, it starts decomposing into TiC_x , a Ti-rich and Ti_3AlC ; when in contact with molten Cu, the resulting phases are $\text{Ti}_2\text{Al}(\text{Cu})\text{C}$, $\text{Cu}(\text{Al})$, AlCu_2Ti and TiC . In the presence of Cu at approximately 1630 °C, a defective $\text{Ti}_2\text{Al}(\text{Cu})\text{C}$ phase was formed having a $\text{P6}_3/\text{mmc}$ 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 $\text{Ti}_2\text{AlC}/\text{Ti}_3\text{AlC}_2$ composite with Ti or Cu filler materials.

Keywords : MAX phase, Joining, microstructure, hardness, Brazing, TIG process