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Joining Ti_3SiC_2 MAX Phase with 308 Stainless Steel and Aluminum Fillers by Tungsten Inert Gas (TIG)-Brazing Process

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Abstract: Herein we report on the Tungsten Inert Gas (TIG) brazing of Ti_3SiC_2 to 308 stainless steel and Al brazing fillers materials. The microstructures of the interfaces were investigated by scanning electron microscopy and energy dispersive spectrometry. Intensive interactions including dissolution and diffusion simultaneously occurred within the Ti_3SiC_2 and at the Ti_3SiC_2/308 stainless steel interface during TIG-Brazing. The interfacial region between Ti_3SiC_2 and 308 stainless steel filler is comprised of a decomposed Ti_3SiC_2 zone, an interaction layer zone and a modified 308 stainless steel zone. When the Ti_3SiC_2 comes into contact with the 308 SS molten filler during TIG-brazing, it starts decomposing into a TiCx+SiLiquid +Sigas, and simultaneously, deep penetration of the molten 308 SS into the Ti_3SiC_2 occurred to form a complex bright phase containing [Fe, Cr, Ni, Ti, C, Si] and TiCxphase. The loss of Si is attributed to its evaporation during the TIG-brazing process. Thermally induced residual stress due to thermal expansion mismatches create interfacial cracks between the decomposed Ti_3SiC_2 and the interaction layer zone. The phases that most likely form when Ti_3SiC_2 is joined with Al brazed filler material are Al in which some Si is dissolved, $TiAl_3$ and Ti_4AlC_3. No cracks were observed during TIG joining of Ti_3SiC_2 with Al brazing filler material.

Keywords : Tungsten Inert Gas (TIG) brazing, Ti3SiC2