Wetting and joining of SiC ceramics by Al-Ti alloys

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The full exploitation by the aerospace industry of the attractive and unique properties of SiC based composites calls for effective joining technologies that may help to assemble them in complex shapes or to integrate them into existing metallic parts forming hybrid structures.

In view of using liquid-assisted joining processes, such as brazing or transient liquid phase bonding, the wettability of SiC by Al-Ti alloys to be used as brazing material is presented here. These studies show that liquid Al-Ti alloys have a very good wetting behaviour when in contact with SiC. In particular, the Al_3Ti alloy has the most promising interfacial behavior in terms of wetting, adhesion and resulting phases.

Following this line, results are also presented on joining SiC to itself using, in particular, the Al_3Ti alloy as brazing medium. Different brazing routes were pursued, such as capillary infiltration of the liquid alloy between the seam or assembling the joints by sandwiching a paste (Al_3Ti powder + organic binder) and Ti layers between the adjoining materials.

The microstructures and the chemical composition of interfaces were characterized on cross-sectioned samples and interpreted in terms of multicomponent phase diagrams.

The overall strength of the joints was determined by shear and torsional tests at room temperature; the mechanical response coupled with fracture path detected by post mortem analysis was related to the microstructures and process parameters.