

Diffusion brazing of TiAl parts

With high microstructural and chemical homogeneity of the braze zone

Patent status:

EP 17801064.1 Pending

EP 17801063.3 Pending

Challenges

Titanium aluminides (TiAl) are increasingly used in jet engines as a substitute to nickel. Until now no standard processes for high quality joining and repair of TiAl parts exist due to the relative novelty of TiAl parts. Hence no well controlled and reproducible brazing technology for TiAl parts is used in the aircraft industry.

In general braze zones must show high chemical and microstructural homogeneity to provide good ductility and damage tolerance of a repaired or joined part for aircraft appliances.

Technology

The diffusion brazing process of TiAl parts has been developed to function as a new standard process for high quality joining and repair. The technology is enabled via a transient liquid phase, which generates a chemically homogenous microstructure in the braze zone by solidifying the braze zone via interdiffusion of the elements of the braze alloy with the substrate material. It not only allows the closing of irregular cracks but also enables joining various material qualities and parts from different pre-processing routes in a hybrid production process, enabling complex structures as well. So far the results show a good reproducibility and the process is well under control.

The Final product is a joined or repaired part with a high chemical and microstructural homogeneity that provides similar mechanical properties as the virgin substrate material. This opens the way for a wider use of TiAl parts and the possibility of reusing the parts by repairing them, which also leads to a reduction in production and service costs.

Areas of Application

Using TiAl for jet engines, blisks, rotors and other weight and temperature critical parts offers high potential for further weight and consumption reduction. When current parts for this application are substituted with TiAl robust repair and joining processes for those new TiAl parts are necessary.

Development Status

Currently the technology has a ARL of 4, meaning that the technology is validated in lab. In lab brazed tensile specimen where tested successfully.

Exploitation Opportunity

Helmholtz-Zentrum Geesthacht offers the described technology for in-licensing and/or for the further development and exploitation. Within the scope of a cooperation, interested companies can be supported in adapting this technology to their specific requirements.

Publication/Inventor(s)

Hauschildt et al., Diffusion brazing of γ -TiAl-alloys: Investigations of the joint by electron microscopy and high-energy X-ray diffraction, MRS Online Proceedings 2013.

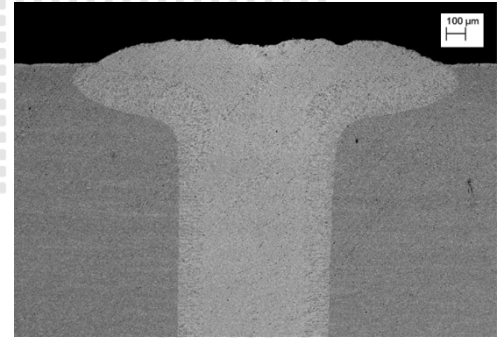


Image: Brazed crack | HZG/WPM

Advantages:

- Repair and joining of TiAl-parts
- High chemical and microstructural homogeneity of braze zone
- Mechanical properties similar to virgin part
- Enables manufacturing of complex parts

Application:

- Repair of TiAl-parts
- Joining of TiAl parts
- Hybrid production process to produce TiAl parts from semi-finished products stemming from different processing routes

Industrial Sector:

- Aviation and aerospace (turbines, blisks, rotors, ...)
- Energy (gas turbines, ...)
- Automotive (piston, connection rods, ...)

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