

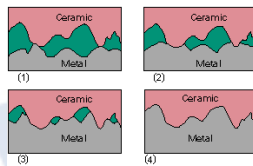
Diffusion Welding in Aeronautic Industry

Diffusion Welding:

Diffusion Welding, also called Bonding or Diffusion, is a solid state welding process which produces coalescence of the facing surfaces by the application of pressure and elevated temperatures (about 50 to 80% of absolute melting point of the parent materials) for a time ranging from a couple of minutes to a few hours.

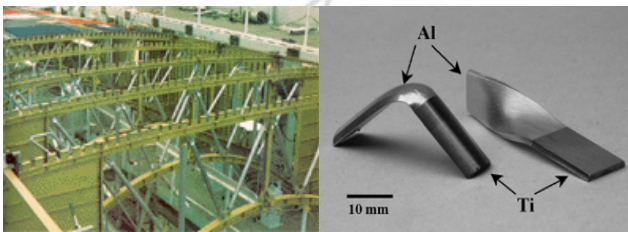
Process parameters:

- Surface preparation
- Temperature
- Time
- Pressure



Materials:

Some of the common materials welded by this type of process for aeronautic and aerospace industry are: Boron, Titanium, Aluminium, Ceramic, Composite, Graphite, Magnesium, among others.



Equipment:

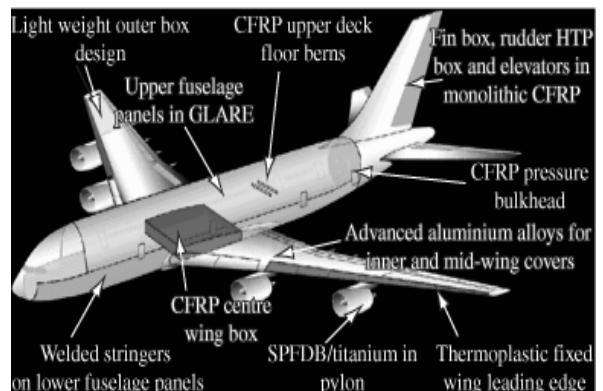
Typically a furnace with an interior vacuum or inert atmosphere and an hydraulic press to apply the required pressure. Other type of equipments replace the hydraulic press by an air compressor that applies an isostatic pressure.

A full control of the temperature and pressure applied to the components is required.

Applications:

Weight reduction and improved damage tolerance characteristics were the prime drivers to develop new family of materials for the aerospace/aeronautical industry, like Fiber/Metal Laminated (FML) or Metal Matrix Composites (MMC). Those advanced materials cannot be welded by conventional techniques because the high temperatures involved would destroy their properties. For such materials, diffusion welding is an attractive solution because it is a solid state joining technique, which is normally carried out at a temperature much lower than the melting point of the material.

The range of applications for this type of welding on aeronautic industry is vast and includes: structural aircraft sections, blades of aircraft engines, electronic components, helicopters rotor parts, space shuttle fuselage, Exhaust components for gas turbines.



Advantages	Disadvantages
Joining of very dissimilar materials	Not suitable for mass production
Material properties not affected by the welding	Initial investment is fairly high
Joins components with little distortion	Weld components with size limitations
Perform several joints simultaneously	Requires a great care of materials surface preparation
High quality bonds with good strength	Costs of heating for long periods of time