In diffusion bonding parent materials are positioned together under an applied force and heated in vacuum, causing atoms from each part to diffuse across and finally eliminate the original interface. Dynamic loads to one million pounds, temperatures greater than 1500°C and closely controlled furnace dwell times are utilized. With TLP (Transient Liquid Phase) bonding, an extremely thin “activation layer” is used to create a short-lived liquid interface at the parent materials being joined.
Several diffusion bonding techniques have been developed as VPE specialties since the company started in 1976. VPE has always been the most experienced and the best equipped commercial facility in North America for these processes. VPE’s cost efficient diffusion bonding processes address critical parameters.

Assembly weights to 10,000 pounds, sizes up to 52 inches in diameter and parent materials as thin as 0.0002 inches are bonded routinely.

**PARENT MATERIAL CAPABILITIES**

- Copper
- Glidcop™
- Nickel
- Inconel™ alloys
- Haynes™ alloys
- Stainless steel
- Aluminum

**VPE’S DIFFUSION BONDING PROCESS CAPABILITIES**

- Molybdenum
- Titanium
- Aluminum oxide
- Magnesium
- Platinum
- Silver
- Gold

**CRITICAL DIFFUSION BONDING PARAMETERS**

- Temperature profile design
- Interfacial features
- Component flatness
- Surface roughness
- Surface chemistry and metallurgy
- Load application profile
- Suitability of product design for bonding
- Service environment
- Strain-based processing
- Production tooling design

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### Example Diffusion Bonding Applications

- NASA – bonding parameter development for mars lander
- Aerojet – space shuttle valve assemblies
- Schilling - robotic assemblies for submarines used in offshore oil industry
- Major medical device corporation – artificial heart implant components
- Microchannel devices for fuel cells, reactors, reformers and heat exchangers

### Other Joining Processes

- Precision brazing
- Electroforming
- Low temperature hermetic sealing
- Press seals
- Thin film coatings
- Hermetic ceramic-to-metal seals
- Soldering

### Overall Capabilities of VPE

- Contract R&D, prototyping, and turnkey product design and production
- ISO 9001-2008 certified manufacturing and processing services
- Many joining processes, including precision brazing and vacuum baking
- Thin film coating, heat treating, comprehensive analysis and testing lab