



Explosive Metal Welding

PA&E bonds a wide range of dissimilar metals to create advanced composite materials with superior performance characteristics.

Innovative ■ Joins ferrous, non-ferrous metals

Reliable ■ Bonded at the molecular level

Permanent Bond ■ No galvanic corrosion

Flexible Solution ■ Variety of metal combinations available



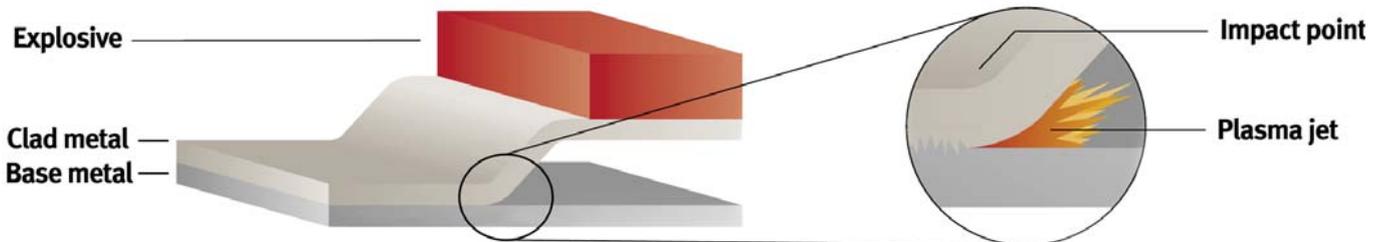
Explosively Welded Metals

Overview



Material Bonding

Design engineers are often faced with the dilemma of material selection. Frequently, material that would work the best for one specific element of the design is lacking in properties required by other elements of the design. For example, a material may exhibit good corrosion resistance, electrical or thermal conductivity, yet be lacking in the strength, hardness, weldability or wear characteristics required by the final design. Explosively bonded metals, produced by PA&E, allow design engineers to specifically place certain materials exactly where they need them without compromising other critical design elements. Design engineers who apply these principles of explosive bonded metals in applications hold a distinct advantage over those who don't.



Explosive Welding

This solid-state welding process uses controlled explosive energy to join two or more dissimilar metals at the atomic level. This process results in a permanent, solder-free metallurgical bond. A weldable bimetallic transition is one of the most common applications of explosively bonded metals and explosively bonded metals routinely withstand the rigors of forming and forging operations.

Explosively Welded Metals

Weld Transitions

Explosively bonded metals can be used as weld transitions between two dissimilar metals, allowing designers and fabricators to apply the best-suited materials to a location or function, when they cannot make the entire structure out of just one of the metals, thereby optimizing the design. This technique is most commonly used to directly weld high-strength steel parts onto lightweight aluminum or titanium structures.

Precious Metal Conservation

Precious metals, refractory metals and other expensive alloys can be explosively bonded in thin layers to the specific area of a designed part. This technique not only significantly reduces the cost of the manufactured part or material, but also allows for the use of more structurally sound materials, where required.

Galvanic Corrosion

Explosively bonded metals don't experience the galvanic activity that would occur between dissimilar metals that have been mechanically fastened. Maritime customers benefit from the use of explosively bonded metals by designing for weld transitions between dissimilar metals that eliminate galvanic corrosion, even in salt air environments.

Corrosive Resistant Linings

Explosively bonded (or clad) metals are often used as corrosive- or erosive-resistant linings for pressure vessels, chemical process tanks, heat exchangers and tube sheets. This process lets engineers combine a strong, inexpensive outer pipe made of a lower cost structural metal, with a thinner inner lining of corrosive-resistant metal. This process can deliver significant cost savings over a pipe made of solid corrosive-resistant material.

Bearing Surfaces

Similar to process for creating a corrosive lining, bearing materials can also be explosively bonded to sheets of metal. This technique allows a structurally sound component to have a bearing surface clad directly to it, significantly reducing the wear on the part, and improving its operation.

Radiation Shielding

Thin layers of shielding materials, such as tantalum or silver, can be bonded to other structural metals or components. This process has been a cost-effective method to provide radiation shielding to satellites.

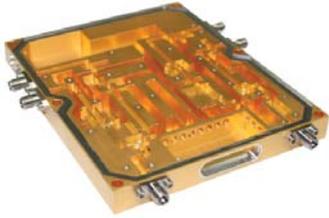
Explosive Hydro-Forming

Explosive hydro-forming is a metal forming technique that uses the energy generated by an explosive detonation to form the metal work piece. Since explosive hydro-forming transmits the explosively-generated energy through water, it can simulate a variety of other conventional metal-forming techniques. This process creates a great deal of flexibility in metal-forming.



Hermetic Solutions for Extreme Environments

Integrated Packaging



Using technologies such as Kryoflex® and explosively bonded metals, PA&E designs and manufactures hermetic packaging for extreme environments — whether it's integrating components that protect satellites deep in space or connectors for oil-drilling tools that bore deep below the earth's surface. By pairing our Kryoflex and explosively bonded metal technologies, we can build hermetic packages using precision laser welding rather than solder joints, thus eliminating the two most common causes for hermetic package failure: solder joint fatigue and cracked glass.

DC Connectors



PA&E's hermetically-sealed rectangular DC connectors exceed most mil-spec requirements and are designed for use in military and commercial applications, where environmental conditions require an extremely rugged and reliable hermetic seal. The uniquely-controlled CTE characteristics, chemical bonding properties and polycrystalline structure of Kryoflex allows PA&E to manufacture these hermetic connectors with 304L stainless steel shells and gold-plated beryllium-copper contacts to maintain excellent electrical performance and environmental characteristics

RF/Microwave Connectors



PA&E's 50 Ohm hermetic RF/Microwave connectors are designed for use in military and commercial applications where environmental conditions require an extremely rugged and reliable hermetic seal. Low-loss Corning 7070 glass is used for dependable electrical performance. PA&E manufactures these hermetic RF connectors from a variety of compatible shell and contact materials, in both laser weld and solder-in styles, which provide excellent electrical and environmental performance characteristics.

Ceramic EMI Filters



PA&E's military-qualified Filter Products Group specializes in the design and manufacture of high-reliability low-pass EMI filters. Utilizing multi-layer ceramic discoidal capacitors and ferrite inductors, PA&E's engineering staff are experts at designing EMI filtering solutions for electronic circuits operating in hostile EMI environments. In-house manufacture and testing, in accordance with MIL-PRF-28861, Class B (QPL) and PA&E class H, are standard practice.

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