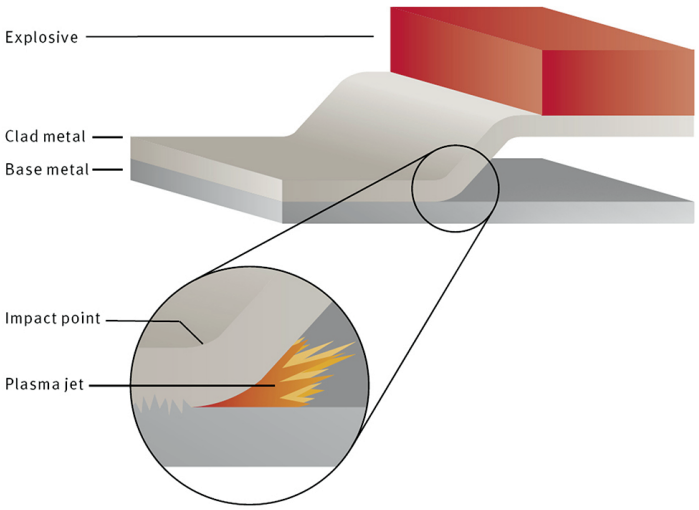
434 Olds Station Rd
Wenatchee, WA 98801

TEL 509.664.8000
URL pacaero.com

Explosively Bonded Metals

PacAero utilizes a solid-state welding process that uses controlled explosive energy to join two or more otherwise incompatible and exotic materials at the molecular level.

This results in a permanent, solder-free metallurgical bond, and can create composites that are lightweight and have superior strength.



How It Works

Plates are accelerated into one another with the forces generated by an explosive detonation. The "Flyer" plate yields to the force of the explosion as the detonation front moves across the surface of the plate. Forces at the collision point cause the first few atomic layers of each surface to become plasma. This leading plasma jet effectively scrubs both surfaces as the collision point accelerates across the plates creating a full metallurgical weld. Explosive metal bonding is considered a cold joining process because the materials remain at or near ambient temperature and retain their original characteristics.

Applications

Design engineers often face the dilemma of material selection. Frequently, the material that would work the best for one specific element of a design lacks properties required by other elements of the design. For example, a material may exhibit good corrosion resistance, electrical conductivity, or thermal conductivity, yet lack the strength, hardness, weldability, or wear resistance required in the final design. Utilizing explosion welded materials can be a powerful solution to this dilemma.



Explosively welded materials allow design engineers to specifically place a certain material exactly where the design requires it, without compromising other critical elements. The correct application of explosion welded materials can yield significant gains in strength, reliability, and cost-effectiveness throughout the product's lifetime.

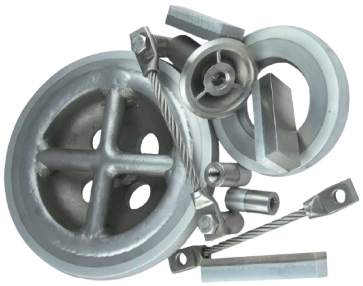
	Zirconium	Vanadium	Tungsten	Titanium	Tantalum	Steel alloy	Steel, mild	Steel, stain	Silver	Rhenium	Platinum	Palladium	Niobium	Ni alloy	Nickel	Molly alloy	Molybdenum	Magnesium	Kovar	Indium	Hafnium	Gold	Copper alloy	Copper	Beryllium Cu	Al Bronze	Al alloy	Aluminum
Aluminum	X	X	X	X	X	O	X	O	X	X	X	O	X	O	O	X	X	O	O	O	X	X	X	X	O	O	X	X
Al alloy	X	X	X	X	X	O	O	O	X	X	X	O	X	O	O	X	X	O	O	O	X	X	X	X	O	O	X	
Al Bronze	O	X	O	O	X	X	X	O	O	O	X	O	X	O	O	X	X	O	X	X	O	X	X	X	O	X		
Beryllium Cu	O	X	O	O	X	O	X	O	X	O	X	O	X	O	O	X	X	O	O	O	O	X	X	X	O			
Copper	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X	X				
Copper alloy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X	X					
Gold	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	X	X	X						
Hafnium	O	X	X	O	X	X	X	X	X	X	X	X	X	O	O	X	X	O	X	O	X							
Indium	X	X	X	O	X	O	O	O	X	O	O	O	X	O	O	X	X	O	X	X								
Kovar	O	X	X	O	X	X	X	X	X	O	X	O	X	X	X	X	X	O	X									
Magnesium	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X										
Molybdenum	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
Molly alloy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
Nickel	X	X	X	X	X	X	X	X	O	X	O	O	X	X	X													
Ni alloy	O	X	X	O	X	X	X	X	X	O	X	O	X	X														
Niobium	X	X	X	X	X	X	X	X	X	X	X	X	X															
Palladium	O	O	O	O	O	X	O	O	O	O	O	X																
Platinum	X	X	X	X	X	X	X	X	X	X	X																	
Rhenium	O	X	X	O	X	O	O	O	O	X																		
Silver	X	X	X	X	X	X	X	X	X																			
Steel, stain	X	X	X	X	X	X	X	X																				
Steel, mild	X	X	X	X	X	X	X																					
Steel alloy	X	X	X	X	X	X																						
Tantalum	X	X	X	X	X																							
Titanium	X	X	X	X																								
Tungsten	X	X	X																									
Vanadium	X	X																										
Zirconium	X																											

Items with an "X" do not require an interlayer.
Items with an "O" require an interlayer.

Marine Shipbuilding Components

High-strength bi-metallic transitions join dissimilar metals together, reducing the need for mechanical joints and preventing galvanic corrosion. High-strength, critical parts can be manufactured incorporating stainless steel/aluminum bi-metallic transitions and welded directly to an aluminum structure without generating galvanic corrosion.

Because of these galvanic corrosion prevention characteristics, explosion welded transition materials have become prevalent throughout the shipbuilding industry. Cylindrically bonded aluminum-to-steel transition rings enable shipbuilders to securely weld forged steel cup-and-cross tie-down elements into the aluminum deck of aircraft carriers.



For more information, contact us at sales@pacaero.com.

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