PA&E: Explosive Metal Bonding

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PA&E Bonded Metals Division:

2249 Diamond Point Road
Sequim Washington
Bonded Metals Division

Who we are:
PA&E Bonded Metals Division
- In operation since 1970
- Formally known as Northwest Technical Industries

What we do:
We use explosives to weld or bond dissimilar metals together and to explosively form metals into exotic shapes that are difficult or impossible to do by conventional methods. Explosives are also used to compact or consolidate metal powders into near net shapes.
The Explosive Metal Bonding Process

Explosive
Clad metal
Base metal
Impact point
Plasma jet
Why Explosive Bonding?

- Perfect for meeting both heavy weight and light weight design requirements
- Much stronger than friction and diffusion welded joints
- Location of bond layers can be controlled within a design
- Weldable bi-metallic transitions (ferrous to non-ferrous)
- Eliminates galvanic corrosion (between dissimilar metals)
- Reduced need for mechanical integration (bolt-on vs. welding)
- Precious metal conservation (linings, facings, etc.)
- Markets for this technology include:
  - Chemical industries (corrosion resistance)
  - Power plants
  - Naval applications
  - Particle accelerators
  - Semiconductor production (sputter targets)
  - Space satellites
The Explosive Metal Bonding Process

Step 1: Metal Preparation

Here, copper and nickel sheets are surface prepped:

Copper Plate

Nickel Plate
The Explosive Metal Bonding Process

Step 2: Metal Preparation

PA&E employees apply shot assembly to bond Inconel to nickel
The Explosive Metal Bonding Process

Step 3: Transporting Material to Remote Blast Site

Noise created by blasts require material to be transported to a remote area for detonation.
The Explosive Metal Bonding Process

Step 4: Preparing for Detonation

Final shot readied for detonation

Hoppers for pouring explosives into charge gap
The Explosive Metal Bonding Process

Step 5: Detonation
The Explosive Metal Forming Process

Step 6: Flattening

Ni/Inconel plates before flattening

Plates after flattening
Bonded Metal Examples

Aluminum/Stainless

- SS Rib
- SS Weld
- Transition Bar
- Al Rib
- Transition Ring
- SS Pipe
- Al Pipe
Bonded Metal Examples

Copper/stainless UHV conflat flange

Custom 6” conflat flange with stainless, copper & stainless

Cu/stainless exit slit for UHV beam line
Bonded Metal Examples

Al Tube/Steel Billet

Copper/Stainless
Bonded Metal Examples

SA 240 2507 SS / SA 516 Grd 70 steel to be machined into a tube sheet in heat exchanger

Copper/aluminum
Testing the Bond

Shear lug testing

Ram tensile testing
Bonded Metal Applications

Current conducting arms made from copper/steel clad

Current conducting arms (CCA) for Electric Arc Furnaces (EAF)

Electric Arc Furnace
Bonded Metal Applications

Clad Tubes

Copper/stainless

Aluminum/steel

Tantalum on I.D. of steel pipe

70/30 Cu-Ni/steel
Bonded Metal Applications

Alum tube/steel billet

Fabricated into high-strength, corrosion-resistant aircraft tie-downs

Deployed on US Navy aircraft carriers
Explosive Metal Bonding

Learn More

Contact PA&E’s Bonded Metals Division via:
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Or Visit: