

## Explosive Metal Bonding Capabilities



## SOURIAU PA&E Bonded Metals Division:



2249 Diamond Point Road  
Sequim Washington



## Who we are:

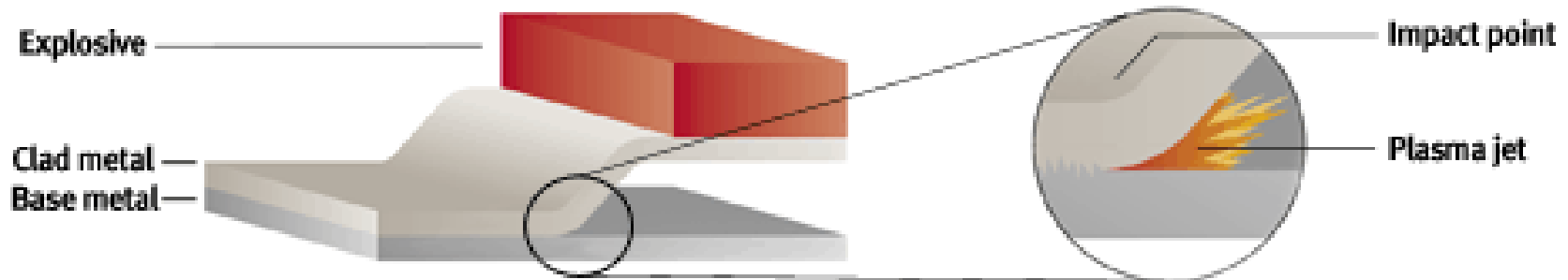
### SOURIAU PA&E Bonded Metals Division

- In operation since 1970
- Formally known as Northwest Technical Industries
- Part of SOURIAU PA&E since 1995

## 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 Bonding Process



## Why Explosion Bonded?

- 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

# Creating Explosively Bonded Metals

## Step 1: Metal Preparation

Here, copper and nickel sheets are surface prepped:



Copper Plate



Nickel Plate

# Creating Explosively Bonded Metals

## Step 2: Metal Preparation

SOURIAU PA&E employees apply shot assembly to bond Inconel to nickel



# Creating Explosively Bonded Metals

## Step 3: Transporting Material to Remote Blast Site

Noise created by blasts require material to be transported to a remote area for detonation



# Creating Explosively Bonded Metals

## Step 4: Preparing for Detonation



Final shot readied for detonation



Hoppers for pouring explosives into charge gap

# Creating Explosively Bonded Metals

Step 5: Detonation



# Creating Explosively Bonded Metals

Step 6: Flattening



Ni/Inconel plates before flattening



Plates after flattening

# Explosive Bonded Metals Examples

## Aluminum/Stainless



SS Rib

SS Weld

Transition Bar

Al Rib



Transition Ring

SS Pipe

Al Pipe

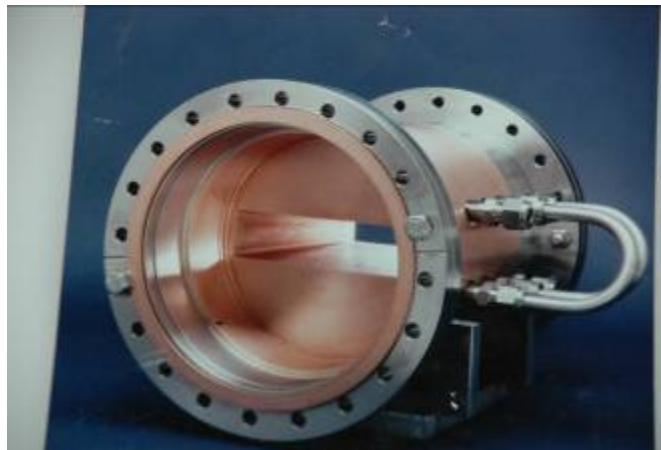
## Explosive Bonded Metals Examples



Copper/stainless  
UHV conflat flange



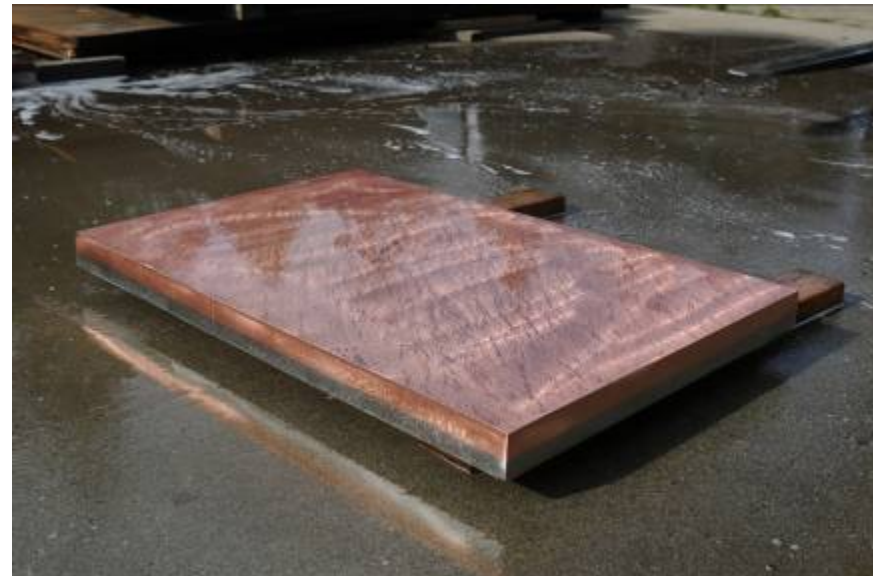
Custom 6" conflat  
flange with  
stainless, copper  
& stainless



Cu/stainless exit slit for UHV beam line

## Explosive Bonded Metals Examples

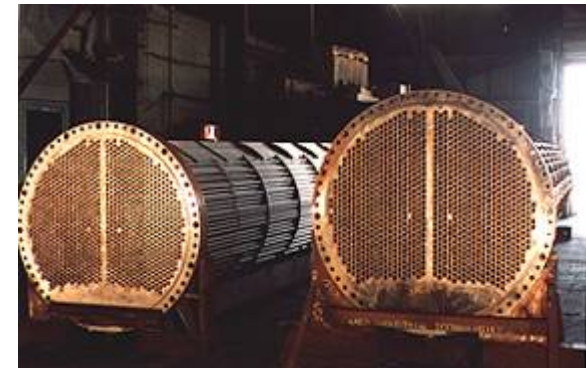
Alum Tube / Steel Billet



Copper / Stainless

# Explosive Bonded Metals 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

Quality Assurance includes bend testing, chisel testing, shear lug testing, ram tensile testing, die penetrate testing, ultrasonic testing and mag. partial testing



Copper/aluminum bend test

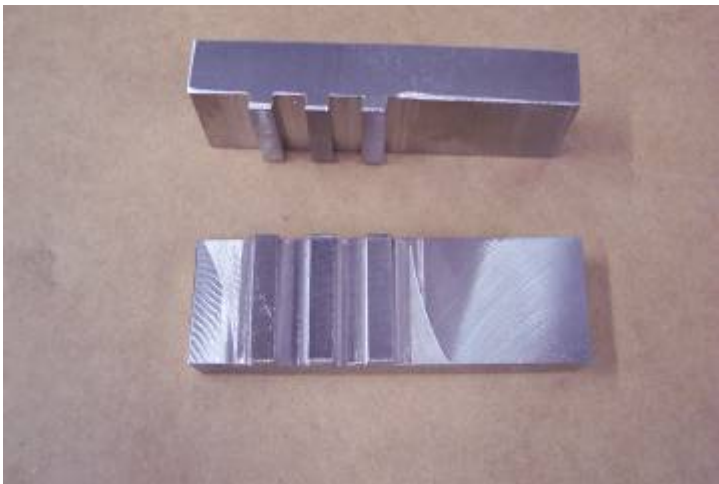


Aluminum/stainless steel hammer test

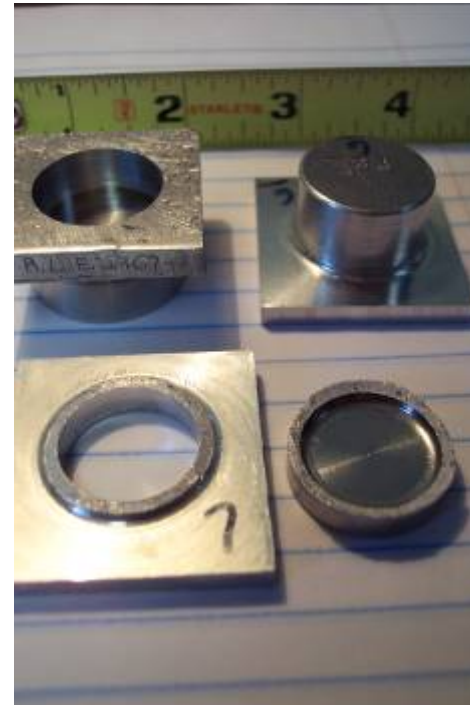


Tensile test

# 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  
recycling scrap metal

# Bonded Metal Applications

## Clad Tubes



Copper/stainless



Aluminum/steel



Tantalum on I.D. of steel pipe



70/30 Cu-Ni/steel

# Naval Applications Bonded Metal Applications



Alum tube/  
steel billet



Deployed on US Navy aircraft carriers

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



## Learn More!

Contact SOURIAU PA&E's Bonded Metals Division via:

- E-mail at [bondedmetals@pacaero.com](mailto:bondedmetals@pacaero.com)
- Phone at: 360-683-4167

Or Visit:

- <http://www.pacaero.com/products/explosive-bonding.htm>