



# Pulse Puddle Arc Welding (PPAW) the research data

Welders Do It Better With Pulse Puddle Arc Welding



## RESEARCH DATA USING PPAW TECHNOLOGY

### 1. U.S. DEPARTMENT OF ENERGY

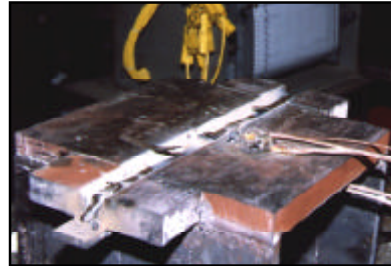
The 4140 plates not Pulse Puddle Arc Welded were cracking at the weld crater at the end of each pass made. This did not occur when Pulse Puddle Arc Welding was used. This could be very significant when welding high strength materials where there are weld starts and stops in the middle of a weld assembly.

Test Samples	PSI	MPa
<b>PPAW Treated</b>	<b>86,500</b>	<b>569</b>
Preheated	69,000	475
Untreated	45,000	310
<b>PPAW treated weldments were 92% stronger than untreated and 25% stronger than preheated weldments.</b>		

Table 1. Weld joint strength 30 days after welding, carbon steel.



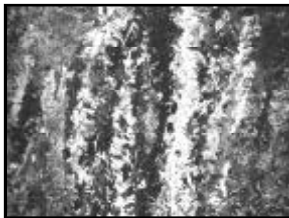
Test plates, A36 (or 4140), welded with PPAW.



Test plates were restrained for 30 days before testing.

### 2. BONAL CORPORATION

"Using PPAW on two different setups resulted in grain refinement of the weld metal from both setups compared to the untreated weld."



Normal weld metal.



Setup #1: PPAW treated.



Setup #2: PPAW treated.

### 3. WAYNE STATE UNIVERSITY

Test Samples	Ductility Value
<b>PPAW Treated</b>	<b>22.0%</b>
As Welded	5.4%
<b>Plates welded with PPAW were 307% more ductile than the standard welded plates.</b>	

Table 2. Ductility summary of 1020 plates.

### 4. CHARLES BRONSON

(Metallurgist and Instructor at LeTourneau University)

Test Samples	Charpy Impact (-50° F)
<b>PPAW Treated</b>	<b>6.4 ft.-lbs</b>
As Welded	3.6 ft.-lbs
<b>PPAW treated plates had a 77% higher impact value.</b>	

Table 3. Charpy impact values from N-20 plates.



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### 5. GRUMMAN AEROSPACE



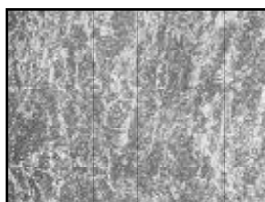
PPAW treated 6061-T6 test plates.

Test Samples	Yield Strength	Ultimate Strength
<b>PPAW Treated</b>	<b>71,000 psi</b>	<b>80,000 psi</b>
Standard Processing	60,000 psi	72,000 psi
<b>PPAW treated plates were 11-18% higher strength than the standard processed plates.</b>		

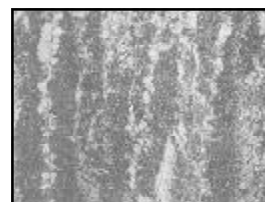
Table 4. Strength Summary from 6061-T6 test plates.



6061-T6 test plates after welding.



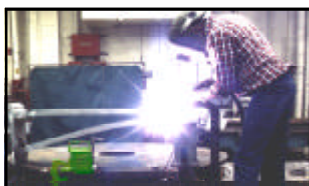
Photomicrograph of PPAW treated weld.



Normal weld metal following standard processing.

Test Samples	Distortion
<b>PPAW Treated</b>	<b>0.161 inches</b>
Standard Processing	0.524 inches
<b>PPAW treated fixtures had 69% less distortion than the standard processed fixtures.</b>	

Table 5. Distortion summary of 6061-T6 fixtures after saw cut.



PPAW treated aluminum fixtures.



Side-by-side comparison after saw cut.

Test Samples	Distortion
<b>PPAW Treated</b>	<b>0.375 inches</b>
As Welded	5.500 inches
<b>PPAW treated disk had 93% less distortion.</b>	

Table 6. Distortion summary after welding 10-foot diameter A36 disks.



10 foot diameter disk after welding.