

AMET

WORLD-CLASS WELDING AUTOMATION

ADVANCED WELDING SYSTEMS FOR ADVANCED PROCESSES

THE CLADIATOR CONCEPT

Multiple small diameter electrodes, placed side by side, paralleled electrically, perform like a strip with greater process flexibility.

Possible variations of the basic concept:

- Electrodes can be added if a wider bead is desired.
- Electrode placement and spacing can be varied to change the shape of the weld bead.
- Electrode size can also be varied based on position to change the deposit shape.
- Independent wire speed also allows deposit shape to be varied.
- Electrodes in the pool can be of different composition.
- Multiple systems (electrically isolated) can be interlaced to reduce the magnetic effect.

ANY WIDTH - ANY COMPOSITION

CLADIATORTM

Multi-Wire Replacement of Strip Cladding / Hardfacing

**LINCOLN[®]
ELECTRIC**

THE WELDING EXPERTS[®]

CLADIATORTM IS A TRADEMARK OF LINCOLN GLOBAL

Key benefits of the Cladiator Process:

Welding materials

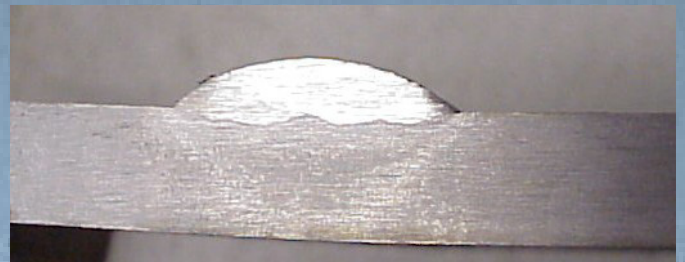
- » Compared to "regular" welding wire, cladding strip is expensive
- » Not as many compositions of cladding strips are available, while there is a much wider range of welding wires suitable for cladding
- » Making a custom composition welding wire is less expensive than making a custom composition welding strip

Equipment

- » Cladiator welding fixture and torch are more flexible and less complex compared to those used for traditional strip cladding and surfacing
- » The Lincoln Electric PowerWave AC/DC 1000SD is easily paralleled to increase deposition rate still staying at low dilution rate.

Most strip applications use SAW DC power supplies. The wider the strip, the more current the application needs. So it is not uncommon to see two DC-1000 in parallel on some/most strip applications. But using DC units in parallel means more heat on the strip and consequently more penetration and higher dilutions.

- » The contact tips on the Cladiator are less expensive than on strip heads and can potentially provide longer life.



Quality of Weld

- » Overlap zones are more level with Cladiator welding;
That is because with the Cladiator process the wire speed rates and power (with multiple power supplies) can be individually controlled – for instance, the outer pair of wires can have different feed rates and heat inputs to better control the edge effects.
- » Middle of the weld profile is more level using Cladiator.
Though some strip heads include a form of magnetic oscillation to help keep the weld puddle as flat as possible and keep the contour less, these are not very advanced and have to be manually adjusted during the welding process. These would have to be changed based on strip type and width. Without these magnetic poles on each side of the strip puddle, the center of the puddle can be significantly higher than the two edges - a convex profile will happen on most strip.
- » Cladiator has a huge advantage allowing very good control over the welding pool properties and control of the welding pool.
Power Wave AC modes can provide for control of the penetration and ensure good deposition rates while still maintaining a low dilution

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ADVANCED SYSTEM SOLUTIONS

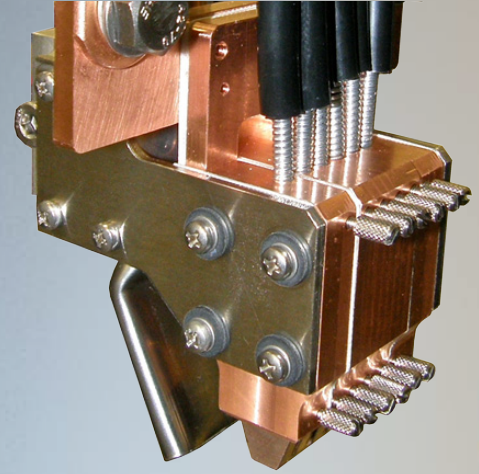
Advanced Welding Systems for Optimal Control of Multiple Wire Cladding Processes

Advanced Integrated Controls

- All welding process parameters are programmed and controlled via a single digital controller.
- Independent control of each wire for improved control of clad edges and overlap.
- Direct digital control of the Lincoln Power Wave supplies via Arc Link
- Built-in Ethernet communication and Process Monitoring

Advanced Weld Head

- Unique design to accommodate up to 8 wires.
- Wires can be isolated to allow for multiple power supplies. This allows wires to be grouped, such as the inside wire and 2 outside wires, and deposition parameters optimized to optimize surface flatness.
- Quick-change, long life contact tip design.



XM Controls



Advanced Power Supplies

- Complete Integration with any number of Lincoln Power Wave 1000SDs for outstanding DC or AC performance

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Production Rate

- » Based on the application, Cladiator systems are able to use bulk wire delivery which reduces costly down time to change out strip.
- » Based on the weld procedure, deposition rates of Cladiator processes could be increased compared to traditional cladding.
- » Machining time needed to get to the smooth surface using Cladiator is significantly less compared to traditional cladding since Cladiator can provide a smoother overlap.



Cost Justification

The cost of applying hardfacing and cladding materials depends on two major factors — material cost and manpower costs. The cost of the consumables of many of these alloys is significant and often greater than the manpower cost.

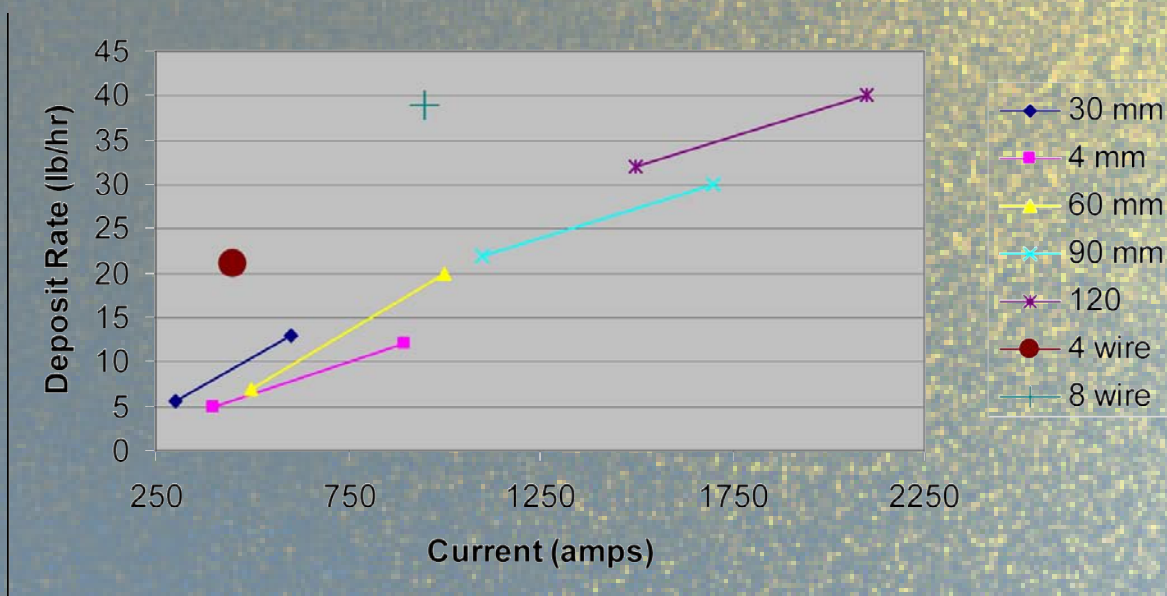
The cost of many high alloy electrodes is calculated as a base cost plus some floating surcharge which varies depending on the supply/demand.

- Comparing the per pound cost of standard 308 stainless electrode, the base cost of strip can be 10 to 30% higher than a .045 (1.2 mm) GMAW wire.
- The lack of availability of strip can also result in surcharges as compared to wire.

To simplify the calculation of the cost of manpower to apply weld deposit, the cost can be equated to the deposit rate of the process.

The graph below compares the deposit rate curves of single wire sub arc (4 mm) to various sizes of strip (30, 60, 90 & 120 mm) to the 4 and 8 wire experiments.

The material cost and manpower cost, and based on achieving higher deposition rates, the multiple wire solution is a very competitive alternative to strip cladding.



WHAT IS WRONG WITH TRADITIONAL METHODS?

Strip Cladding

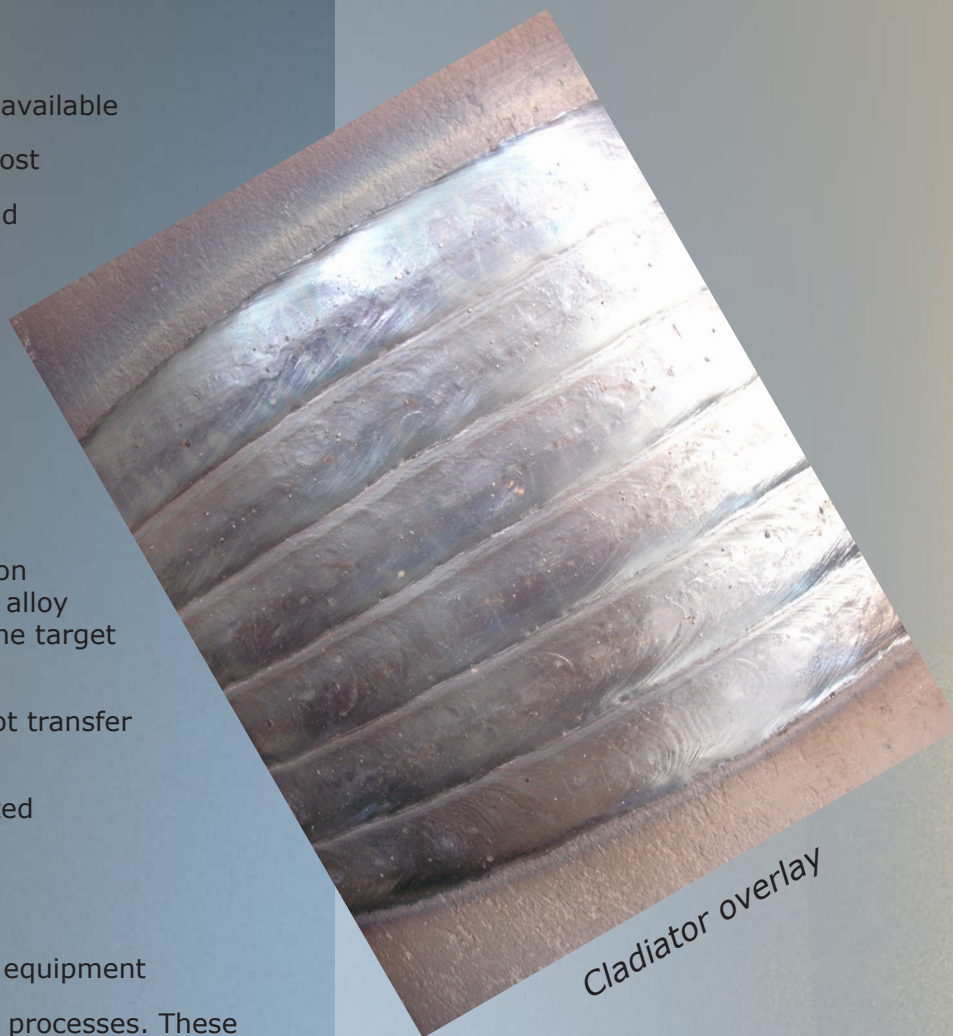
- A limited number of alloys is available
- Higher per pound electrode cost
- A special feeder is needed and wider electrodes require magnets
- Harder to troubleshoot
- Some important alloys will not transfer properly across the arc

Conventional Sub Arc

- Higher penetration and dilution means more layers or higher alloy electrodes needed to reach the target alloy
- Some important alloys will not transfer properly across the arc
- The width of the bead is limited

Laser Cladding with Powder

- Significantly more expensive equipment
- Safety issues related to laser processes. These lasers require eye protection and must be properly contained



Cladiator overlay

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