

A series of approximately 15 teal-colored ellipses of varying sizes and orientations, arranged in a loose, scattered pattern across the right side of the slide. Some are light and semi-transparent, while others are more solid and have a slight shadow.

# **Laser and resistance welding applications for Lithium ion battery and pack manufacture**

# Miyachi Unitek offers both Resistance & Laser welding Solutions

- Resistance welding
  - Supplier of battery welders since 1948
  - World leader in resistance welding technology
  - Key technology developments aligned for battery market
  - Power supply, weld head and monitors
- Laser welding
  - Laser system division formed in early 1990's
  - Pulsed Nd:YAG or fiber laser technology
  - System group offer standard and turnkey custom solutions
- Best fit joining technology offered for each application

# Resistance welding features

- Closed loop inverter technology & capacitor discharge
- Fast rise times for conductive materials
- Power, current & voltage control modes for weld optimization for closed loop supplies
- Cost effective welding solution
- Weld tab thickness up to 0.015"
- Process monitoring
- Self tooling

# Resistance welding Li ion battery applications

- Pack assembly
  - tabs to cells
  - resistors & PCB to cells
- Positive and negative cap connections
- Leak caps & top hat to can



# Resistance welding - tab materials

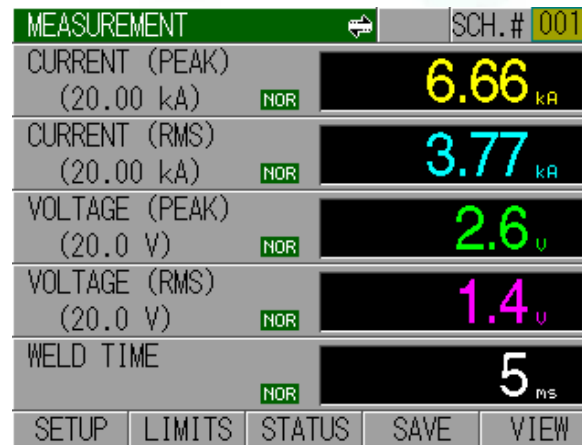
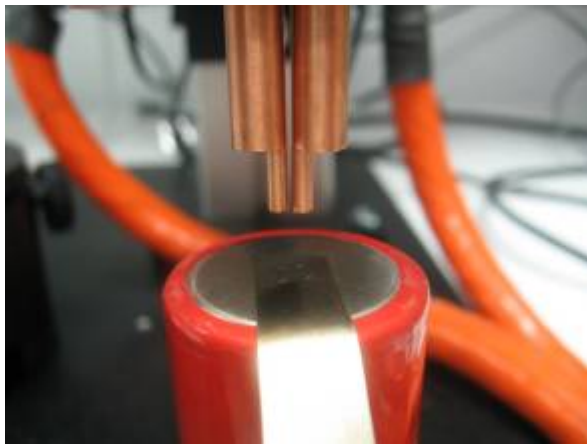
- Broad range of weldable tab and terminal materials
- Thin and thick tabs
  - Nickel up to 0.015"
  - Nickel clad copper up to 0.012"
- Material thickness over 0.007" thickness require slot and projections



0.012" thick nickel clad copper tab  
to steel terminal

# Resistance welding - direct weld monitoring

- Control, set limits & record data
- Current, voltage, power, resistance and displacement



# Laser welding features

- Non contact, high speed
- Laser welding is compatible with can and tab materials, and material combinations
- Seam and spot welding
- Highly flexible welding
  - Weld spot less than 0.01” diameter
  - Penetration beyond 0.06”
  - Control heat input
- No process consumables
- Geared for automation

# Seam welding cans

- Steel or aluminum (3003, 1050, 1100)
- Small and large cans



Lithium ion for laptop



Electrolyte fill plugs

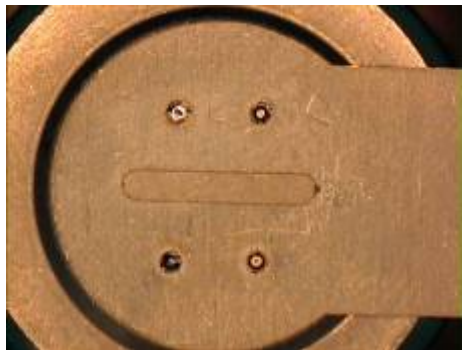
## Battery tab – laser welding

- Flexible weld placement
- Thin and thick tabs
- Conductive tab material
- Material combinations
- High speed welding

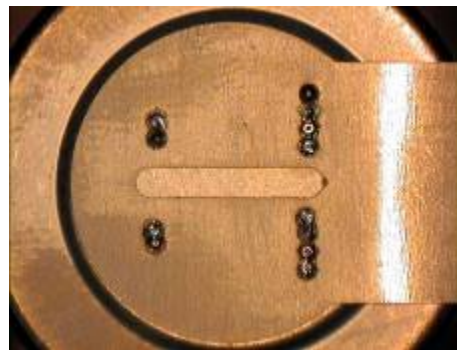


# Flexible weld placement

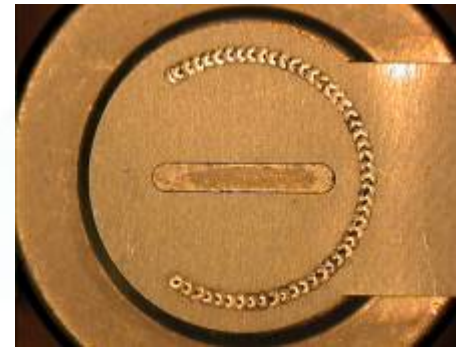
- Weld spots or seam can be tailored to both strength and conductivity



15 lb peel strength



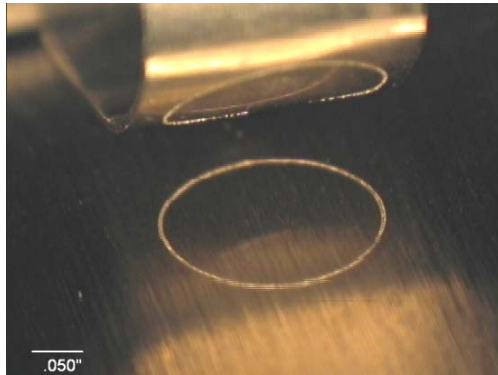
60 lb peel strength



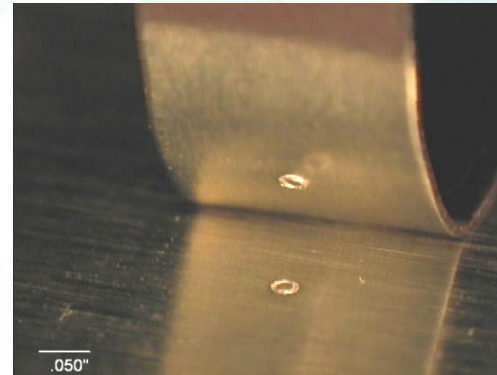
40 lb peel strength in all directions

# Flexible weld shape for peel strength

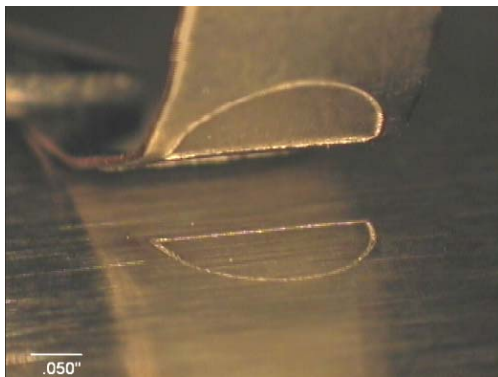
- Customize strength & weld time



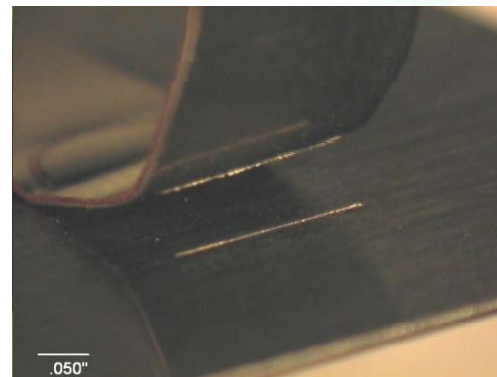
5mm circle, 14 lb



0.5mm circle, 8 lb



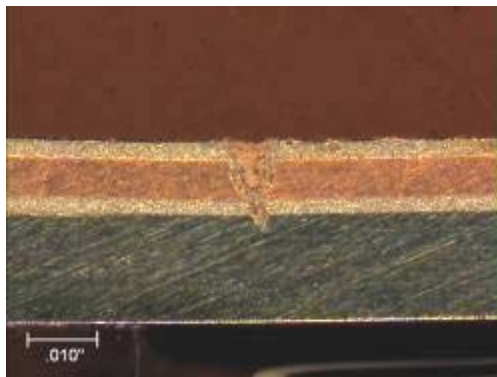
5mm "D", 37 lb



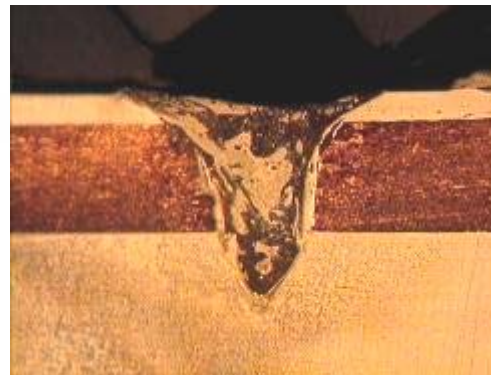
5mm line, 18 lb

# Conductive tab material

- Tab thickness reduction for cost saving
- Conductive tabs required for high power batteries
- Clad materials – Technical Materials



0.012" nickel clad copper to steel



0.02" stainless clad copper to steel

# Tab and terminal material combinations

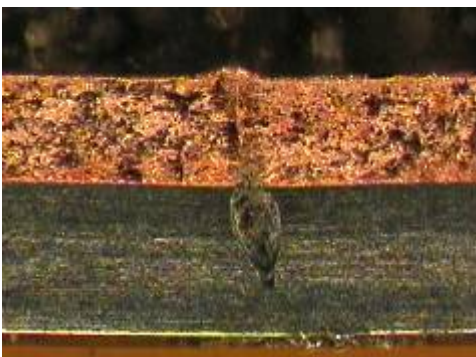
- Laser welding is very flexible for material combinations



0.015" thick nickel to steel



0.012" thick nickel clad copper to 0.015" thick steel



0.012" thick copper to 0.015" thick steel

## High Speed welding

- Welding 0.012" thick nickel clad copper material to aluminum terminal at 4"/s



# Systems solutions

- XYZ configuration according to pack size and weight
- Tables, gantry, galvo head or robot
- Pulsed Nd:YAG or fiber laser sources
- Vision system options



Gantry system

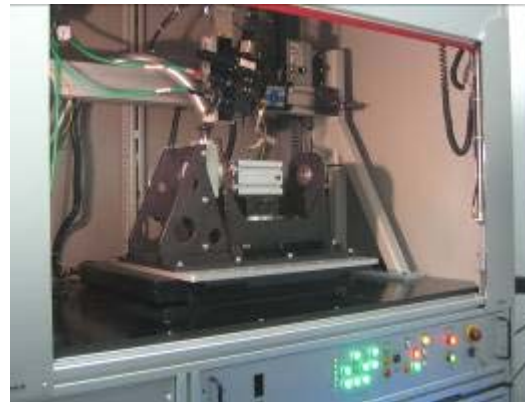


Table system



Galvo system

# Laser Marking of batteries

- Fiber laser marker provides high speed high quality permanent mark on aluminum, steel, copper, nickel and many plastics
- Text, graphics, 1d and 2d codes



Datamatrix™ code in aluminum



Datamatrix™ code in steel