



MICRO WELDING – A NEW APPROACH

Coherent Switzerland AG

06 - 2019 Markus Danner

CONTENT

- Introduction / Technology
- SmartWeld⁺ - beyond wobbling
- Application examples
- Laser systems
- Summary

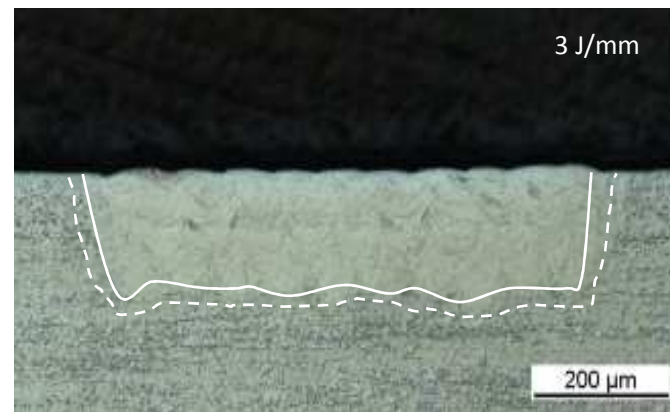
INTRODUCTION / TECHNOLOGY

- High speed stirring of weld pool with small spot size and high energy density using single mode fiber lasers
- Highly efficient process - Reduced energy input by 66%
- Increased welding cross-section by 40% compared to regular, pulsed heat conduction welding
- Reduced heat affected zone HAZ – less thermal stress, less crack formation

... compared to regular, heat conduction welding



Regular penetration and cross section of a spot applied by a pulsed laser, spot size ~ 800μm



Penetration and cross section of a spot applied by a single mode laser, spot size ~30μm, moved rapidly thru the material

SMART WELD+ BEYOND WOBBLING

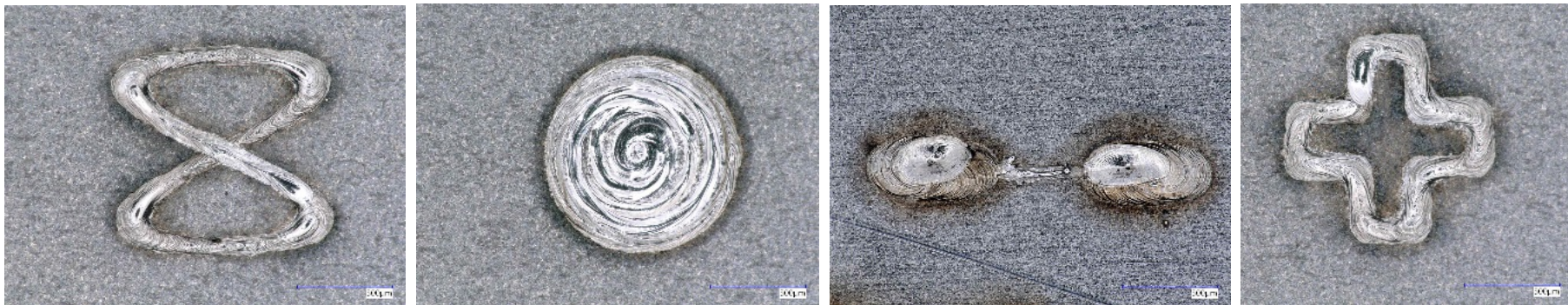
USP



SmartWeld+ processing head

- Optimized dynamics for high speed repetition of micro patterns
- various pre-programmed smart patterns, e.g. eight, spiral, ellipse, etc. – max. 15 patterns to store
- selectable pattern size and orientation (angle) relative to feed direction
- AutoRotate
- synchronization with laser pulses
- Max. oscillation frequency 4 kHz
- excellent viewing quality, steady camera picture
- Compact, low weight

Examples for wobble patterns



SMART WELD+ BEYOND WOBBLING

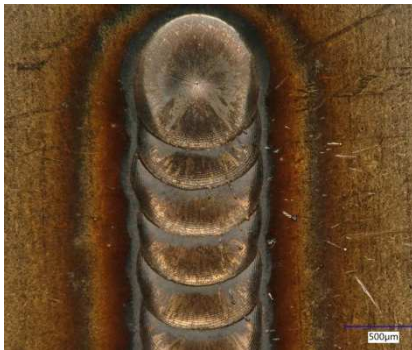
USP



- Welding of dissimilar materials - Improved blending of melt pool
- Welding of challenging metals – reduced spatter, low viscosity and surface tension of the melt reduce porosity and cracks
- Discrete energy input into the material – reduce HAZ
- Increase process stability on highly reflective materials
- Precise penetration depth control – even within material of 100 μm thickness and less
- Extend spot size to compensate workpiece tolerances

SmartWeld + processing head

SF150P SM, Steel, 2mm depth, 800 μm spot



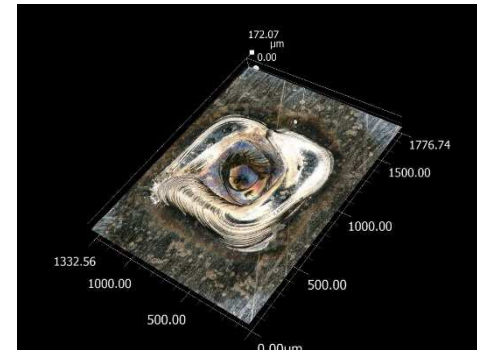
SF150P SM, Steel-Cu, 1mm depth,



SF150P SM, Steel, thin wires, 200 μm

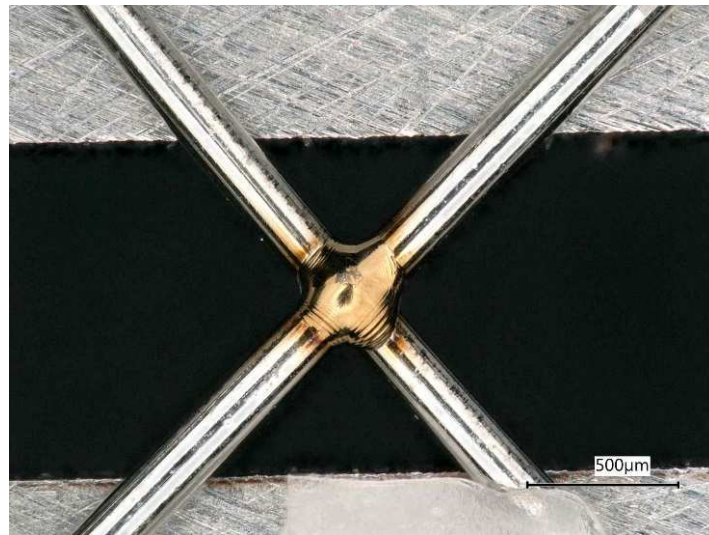
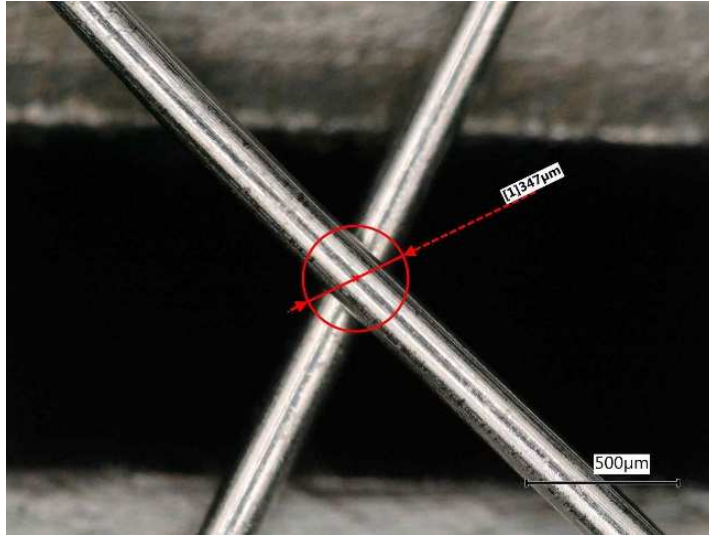


Rectangular spots = min. energy input, max. cross section for pulsed seam welds



SMART WELD+

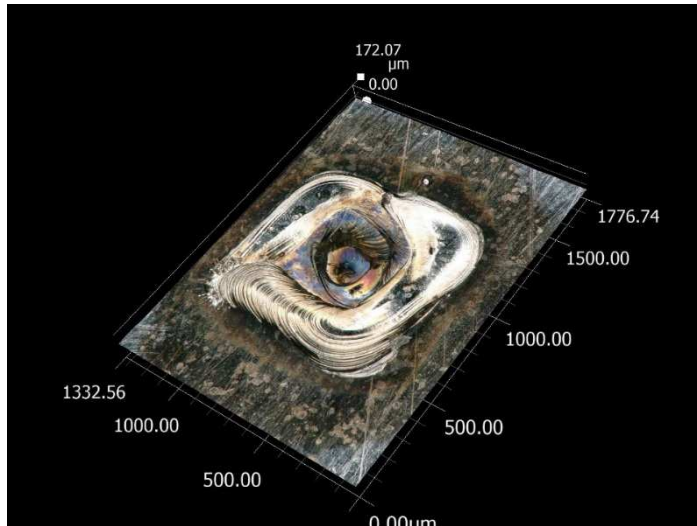
APPLICATION EXAMPLES



- Market: Medical device
 - Material: stainless steel
 - Application: welding of wire mesh
 - Sub-system: SF150P, SmartWeld+
-
- Wire dia.: 200 µm
 - Parameters:
 - Spot size: 30 µm
 - No. of pulses: single pulse
 - Peak: 85 W

SMART WELD+

APPLICATION EXAMPLES

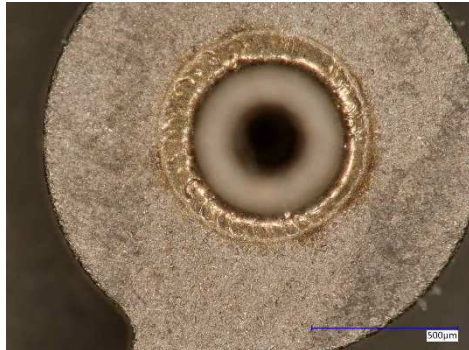


- Market: Medical device
- Material: stainless steel
- Application: welding of 4 layers with homogenous cross section
- Sub-system: SF150P, SmartWeld+

- Layer thickn.: 500 µm
- Welding depth: 1800 µm
- Parameters:
 - Spot size: 30 µm
 - No. of pulses: 7 pulses

SMART WELD+

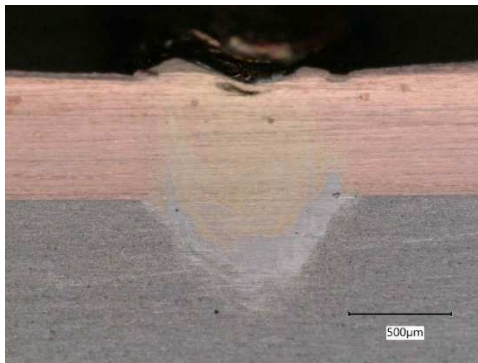
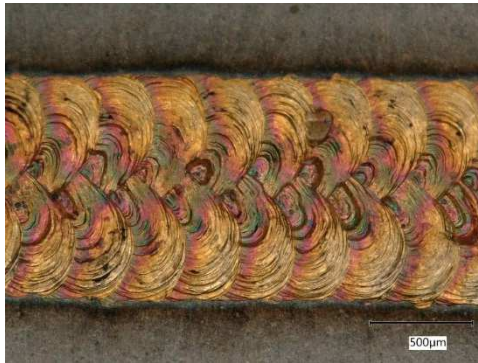
APPLICATION EXAMPLES



- Market: Watch manufacturing
 - Material: brass
 - Application: watch hand
 - Sub-system: SF150P, SmartWeld+
-
- Optimized heat input
-
- Tcycle.: 5 s
 - Osc. Frequency: 2,5 kHz
 - Pulse length: 0,5 ms

SMART WELD+

APPLICATION EXAMPLES



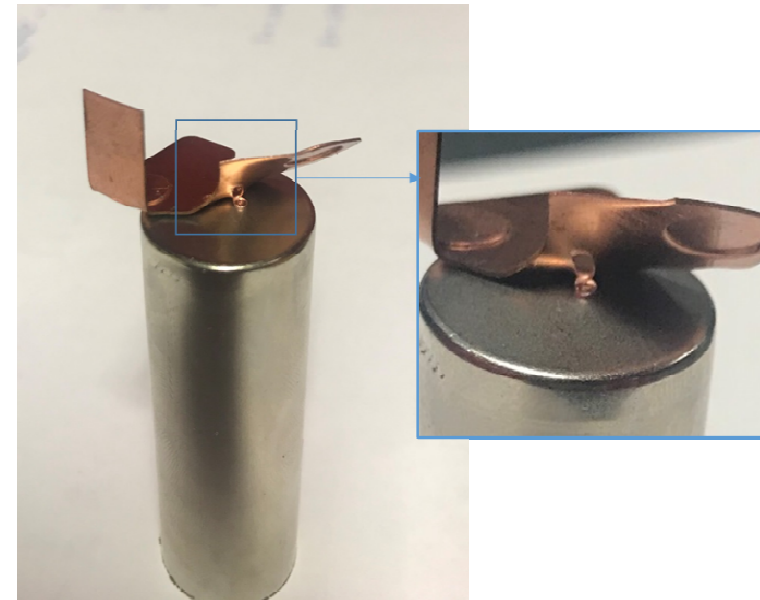
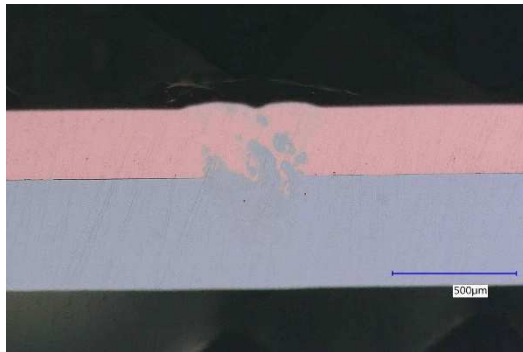
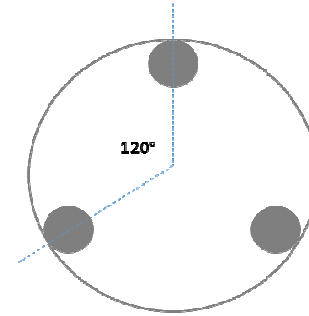
- Market: Battery welding
 - Material: 3x 0,2mm Ni plated Cu to Al
 - Application: Busbar welding
 - Sub-system: FL 010, SmartWeld+
-
- Rectangular, homogenous cross section
 - Very low porosity, minimum pores
 - No impact visible on back side
-
- Length / width: 20mm / 1.4mm
 - Tcycle.: 0.6 s
 - Welding depth: ~1 mm
 - Shear strength: > 1740 N
 - Pavg.: 500 W

SMART WELD+

APPLICATION EXAMPLES

Battery contacts

- Copper (0.2 mm) to stainless (0.3 mm)
- Controlled penetration (uniform)
- Required contact area: 3x 700 μm
- Strong Contact (>150 N)
- 26 ms / spot
- No heat impact at inner side



LASER SYSTEMS – SINGLE MODE

- StarFiber 150 P
pulsed, 1500W peak



- StarFiber 100/200/400/600
cw, 100-600W



- HighLight FL
cw, 500 - 1500W



SUMMARY

- High speed oscillation welding – pulsed or cw with single mode fiber lasers
- Highly precise control of motion, energy input and penetration depth
- Stable welding processes in highly reflective and dissimilar material combinations
- Shape your welding spot or seam in: width, shape, depth and profile
- High speed trepanning of micro holes

Thank you!