



Laser Beam Welding in Vacuum- Industrial Implementations of LaVa-X

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LaVa-X GmbH – Business Model



SOLUTION PROVIDER FOR WELDING CHALLENGES!

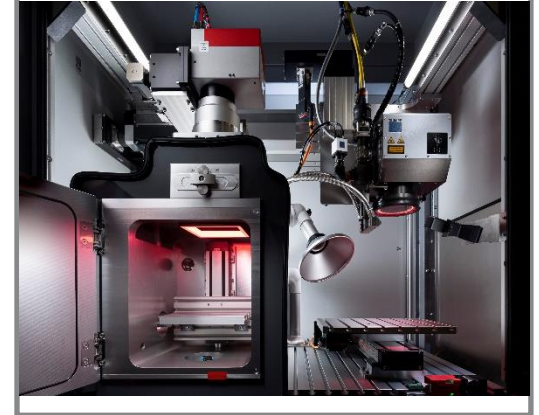
Consulting



Production



Welding Machines



Business Areas of LaVa-X



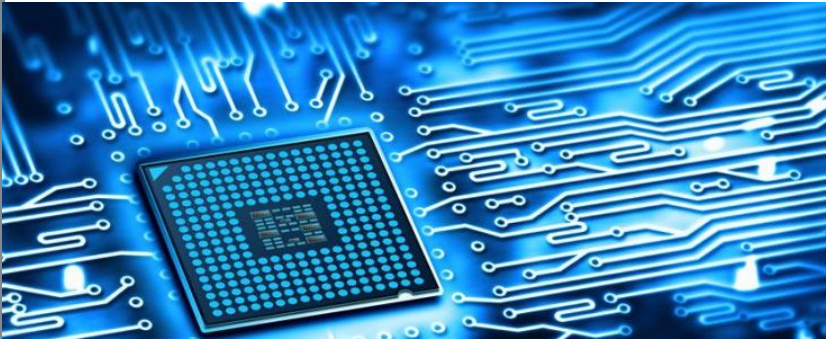
E-Mobility



Aerospace



Sensor Technology



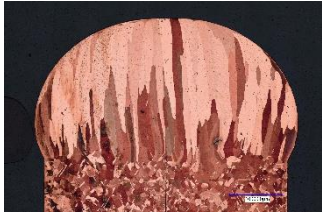
Wind Power



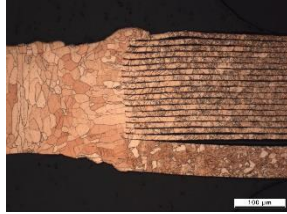
Business Areas of LaVa-X



Hairpin welding for electric motors



Foil welding on battery cell



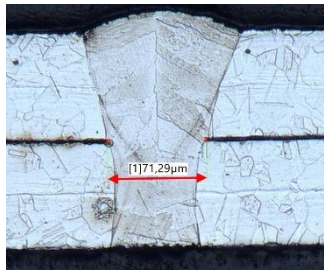
Busbar welding on battery module



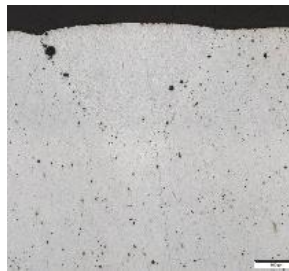
Membrane welding to pressure sensor



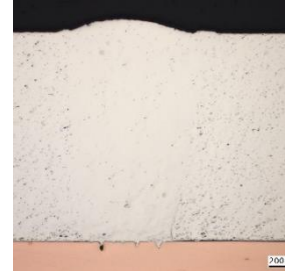
Aluminum welding on satellites



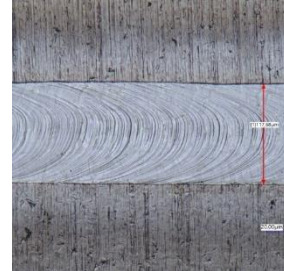
Fuel cell bipolar plate



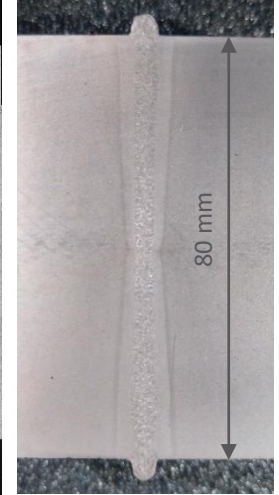
Generatively manufactured AlSi10 alloy



Al-Cu mixed connection on battery contacts



Micro welding on battery module for medical technology

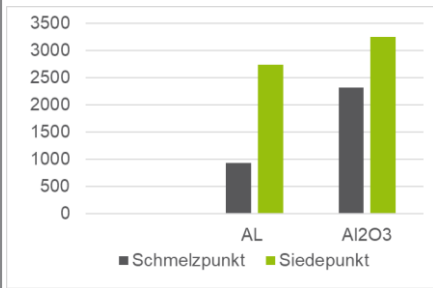
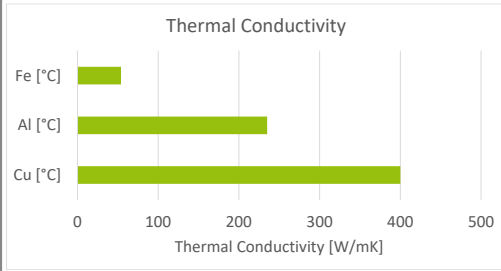


Thick plate welding on wind turbines

Challenges laser welding of Al

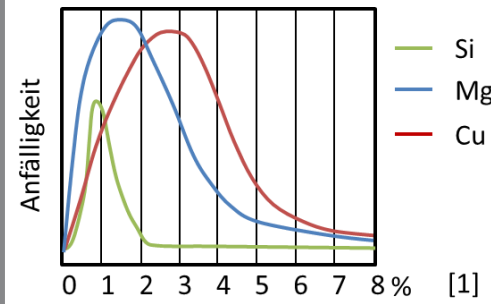
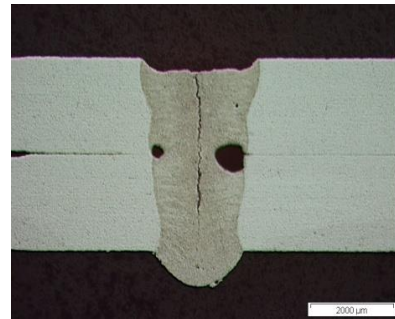


Physics



Temperature [K]

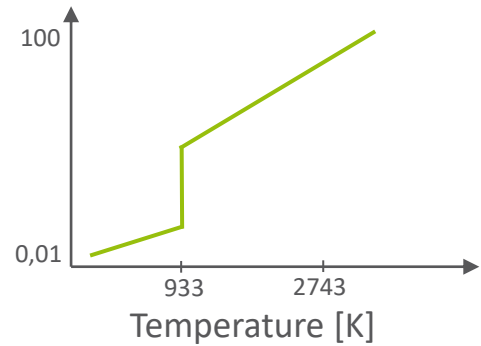
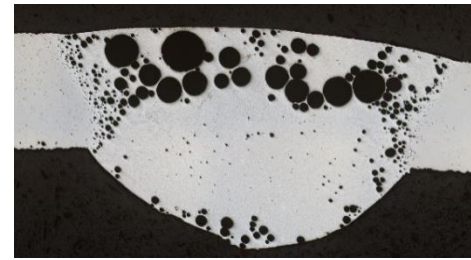
Cracks



Si
Mg
Cu

[1]

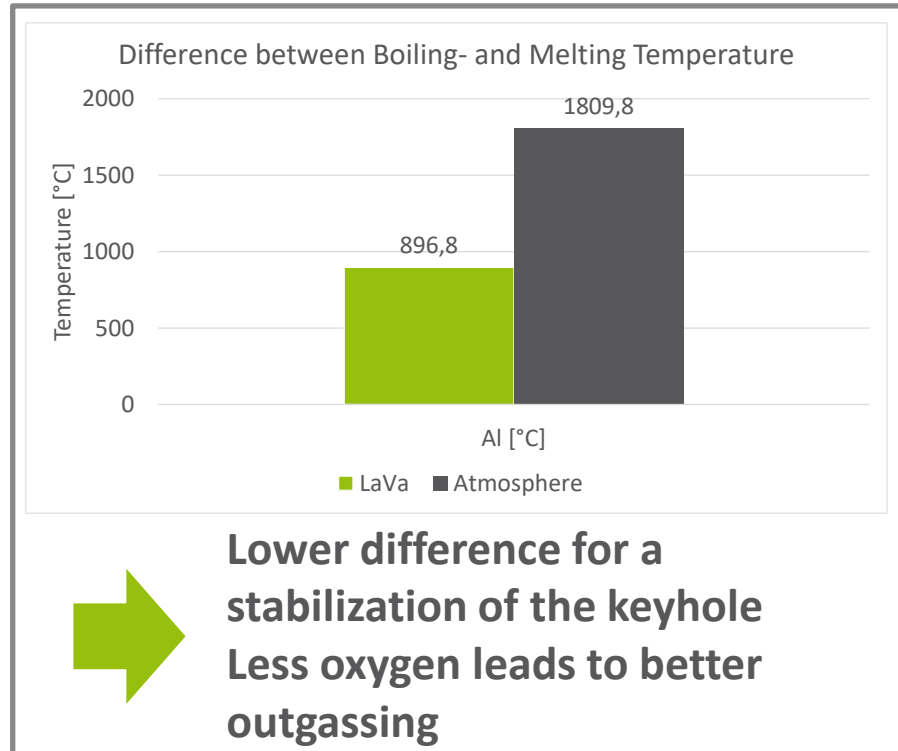
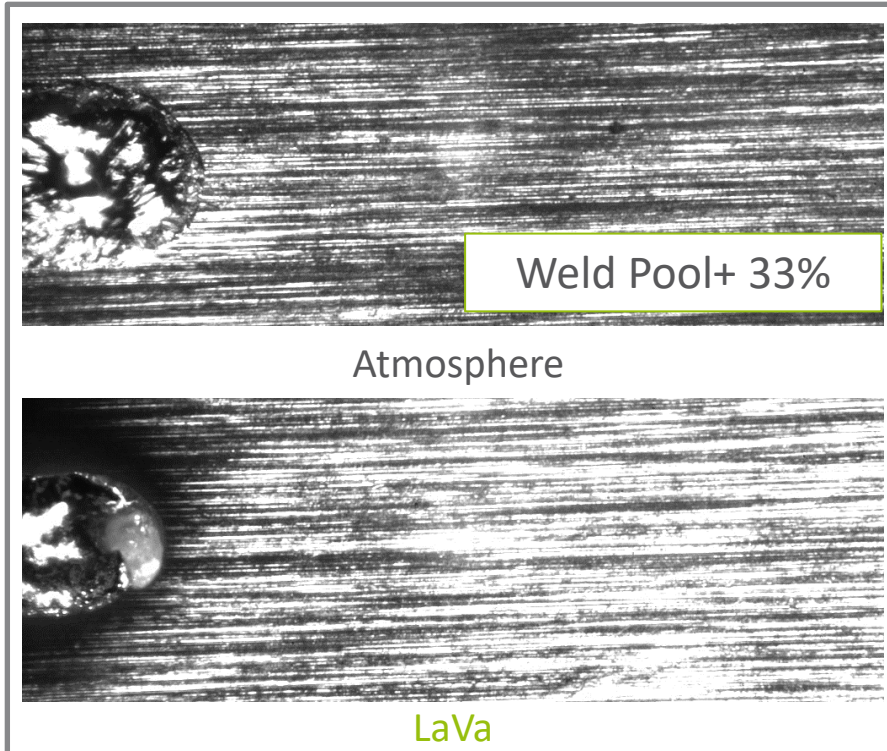
Pores



Temperature [K]

[1] G. Schulze, Die Metallurgie des Schweißens, Berlin: Springer Verlag, 2007

Challenges laser welding of Al



LaLoVak BMWi

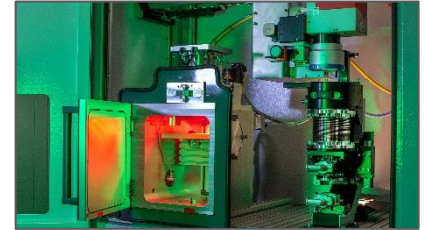


Project LaLoVak

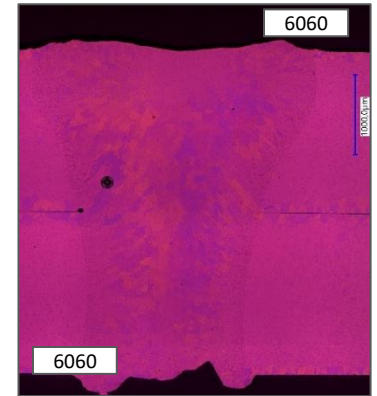
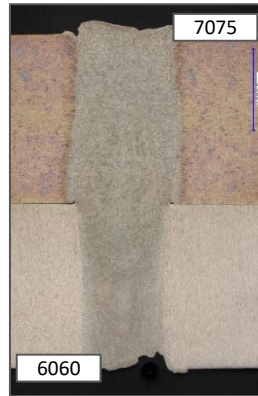
- Reduction of greenhouse gas emissions through the development of laser beam welding with local vacuum in the processing of new types of 7xxx aluminum alloys in automotive body construction.



Federal Ministry
for Economic Affairs
and Climate Action



Implementation LaVa-X



Aluminium Hairpins



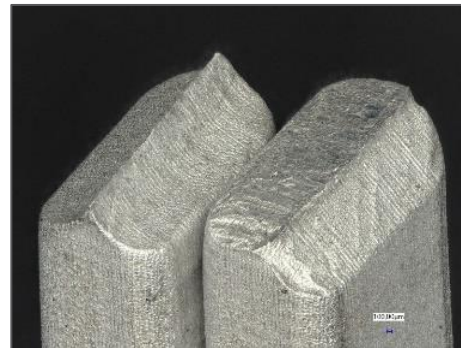
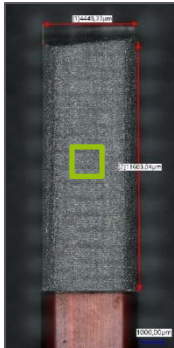
Project Al-Hairpin

- Reduction of weight and costs in the manufacture of hairpins for electric motor stator production.
- Al 99,5 alloy
- Reduction of pores

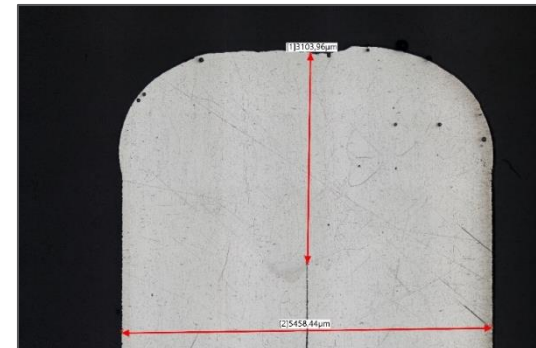


cleanLASER

Implementation LaVa-X

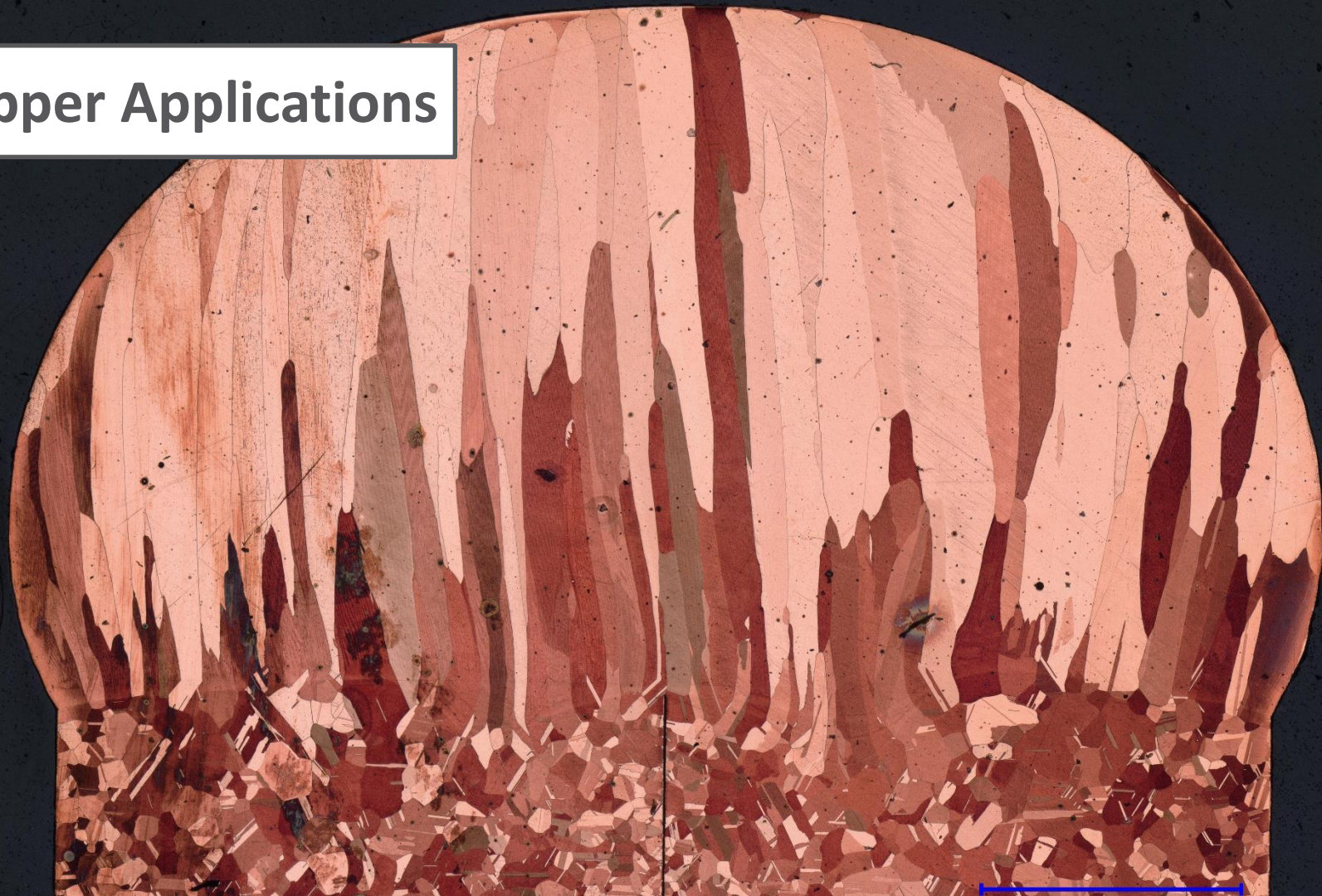


Laser Cleaning



LaVa-Welding

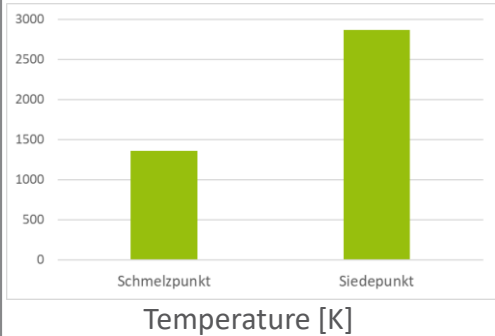
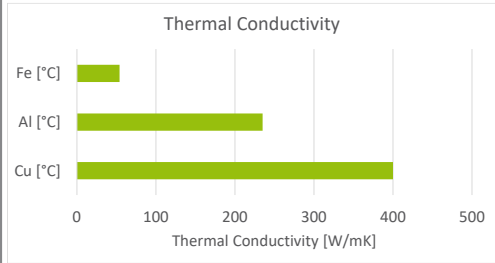
Copper Applications



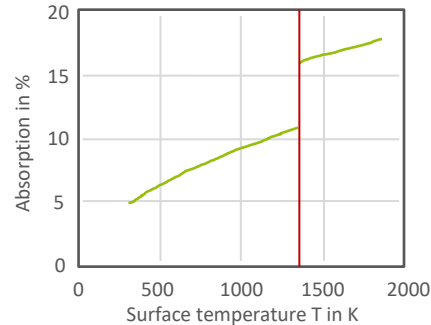
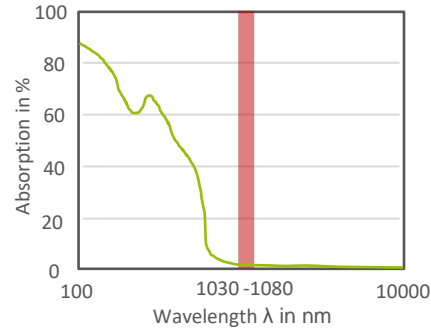
Challenges laser welding of Cu



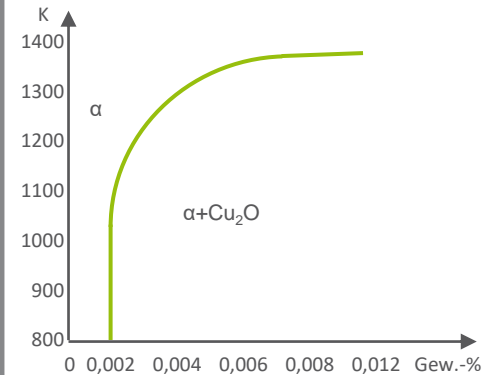
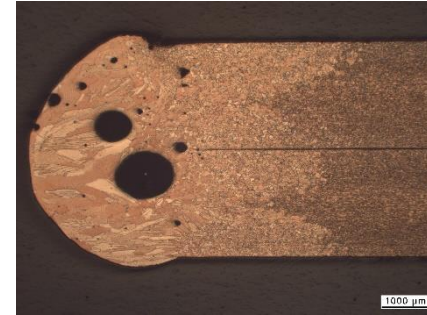
Physics



Absorption



Melting Interval



Challenges laser welding of Cu



<https://www.youtube.com/watch?v=UjfyCW6hRR4>

LaVa-Welding of Copper Busbars



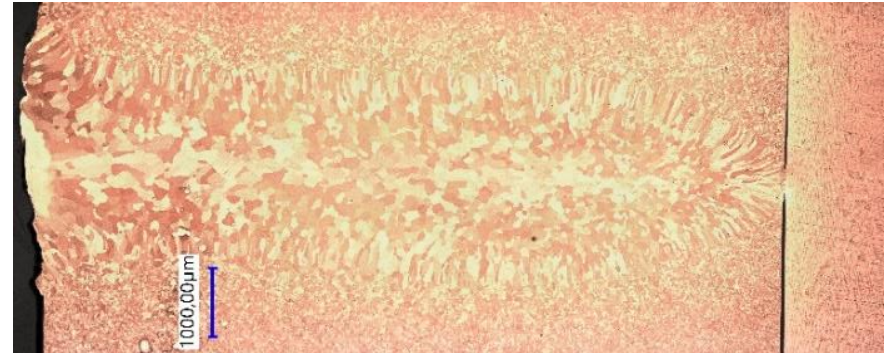
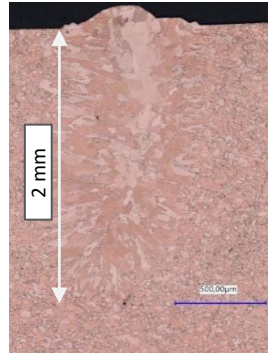
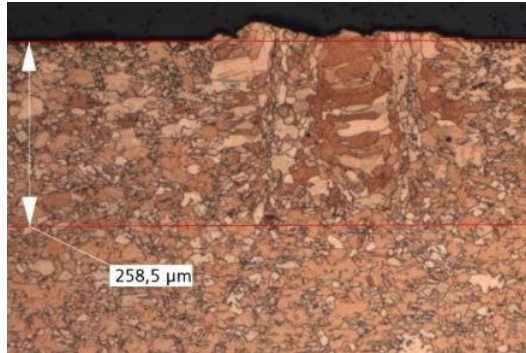
Project Busbar

- Different penetration depth (300 μm up to 11 mm*)
- Different materials (ETP, OF, HCP and DCP)
- Different coatings (Tin and Nickel)
- * with existing TruDisc 12002



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Implementation LaVa-X

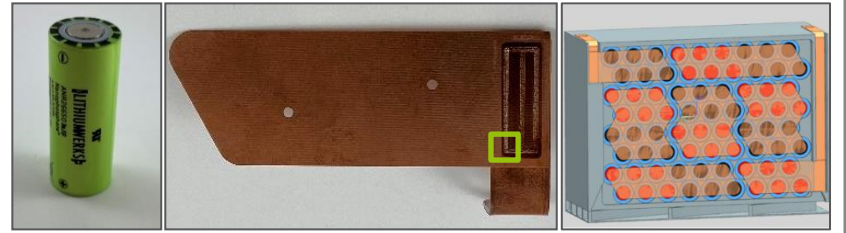


Laser Beam Welding - Welding Battery Pack

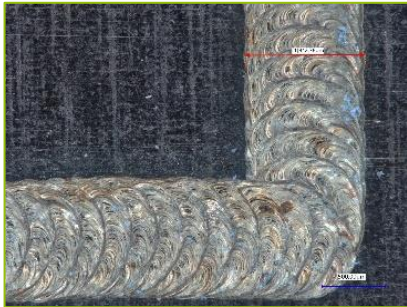


Project Battery Pack

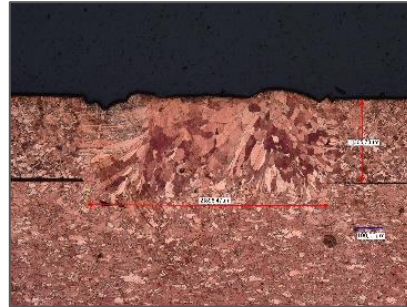
- Battery Back with Lithium-Ion Round Cells
- Welding of Busbars (ETP-Copper)
- Welding of Busbar to Round Cell (Hilumin to ETP Copper)



Implementation LaVa-X



Process-Development
Busbar Welding



Cross Section Busbar
Width >> thickness



Process-Development
Round Cell Welding

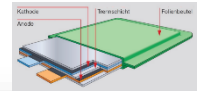
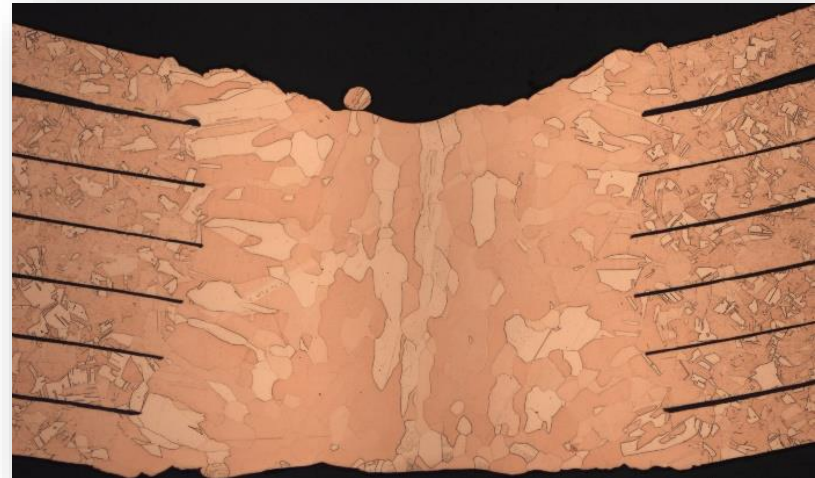
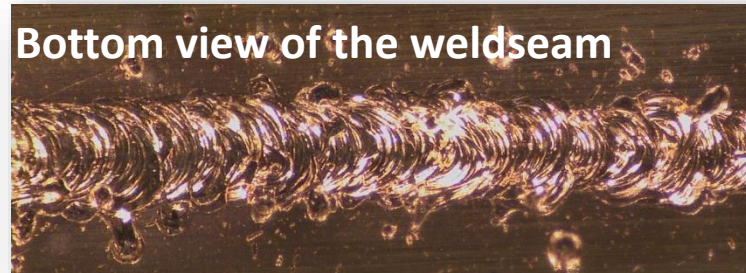


Cross Section Busbar
to Roundcell

LaVa-Welding Copper foils (7 – 63 μm)



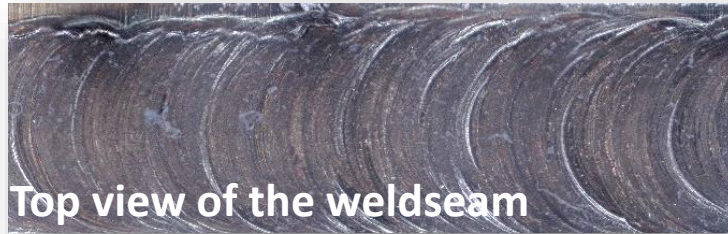
Project Foilwelding



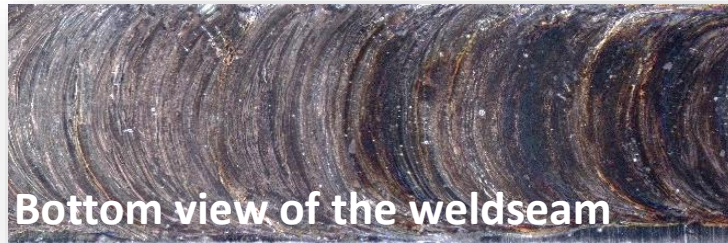
LaVa-Welding aluminium foils (7 – 63 μm)



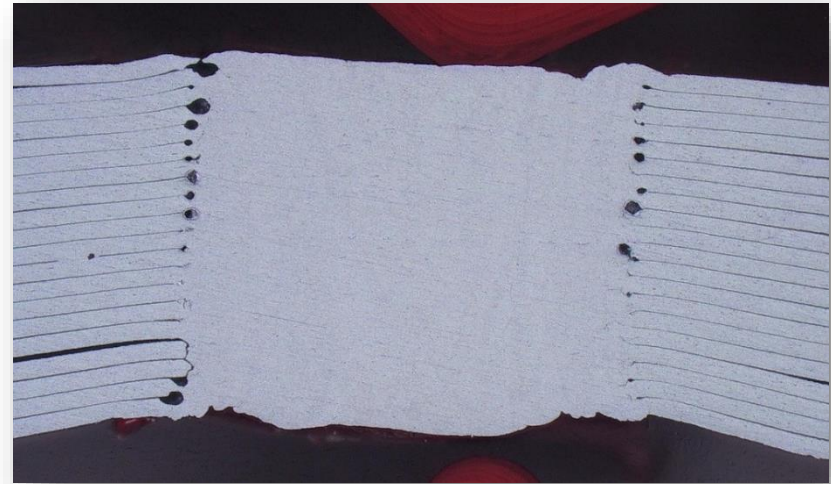
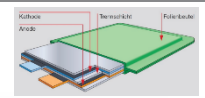
Project Foilwelding



Top view of the weldseam



Bottom view of the weldseam



Conclusion



- LaVa-X is a versatile solution provider for Laser welding and LaVa welding
- Laser beam welding in a vacuum is an established process in the industry.
- The following advantages result from the LaVa technology
 - **Increase of the welding depth or reduction of the laser power**
 - Avoidance of tarnish and vaporization
 - **Reduction of weld spatter and pores**



Thank you for your kind attention

Contact information

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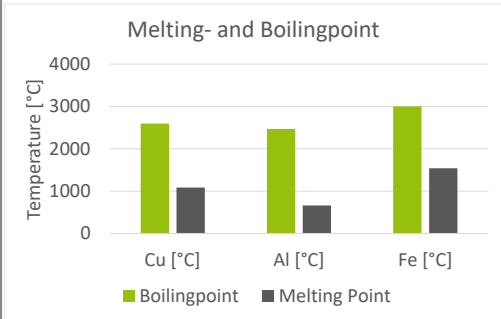
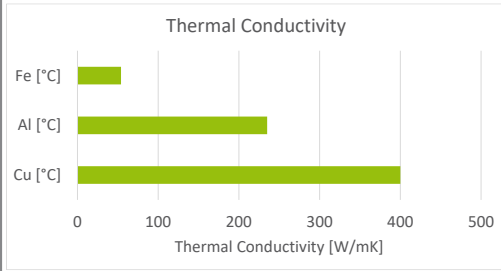
Mixed Materials



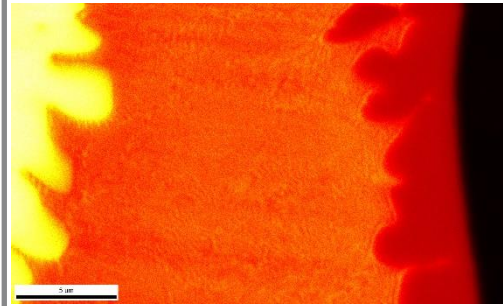
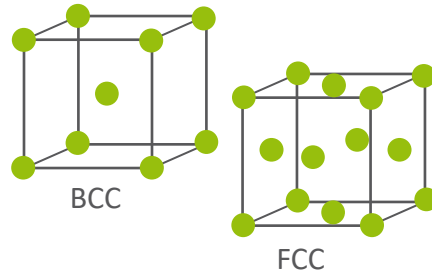
Challenges Welding of Mixed Materials



Physics

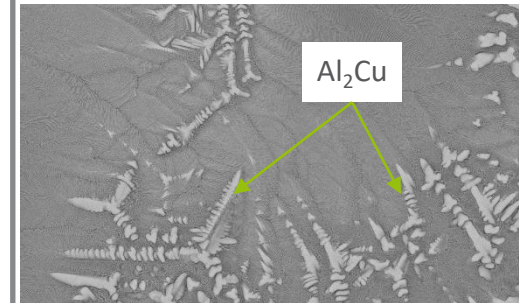
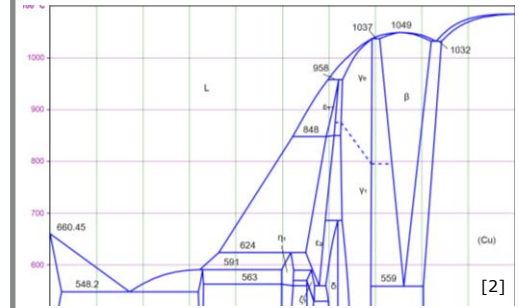


Crystal System



Al-Cu

Intermetallics



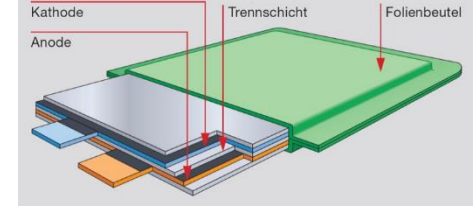
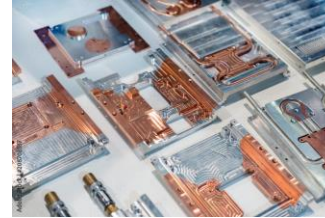
[2] MSI Eureka

LaVa-Welding of Al-Cu Contacts



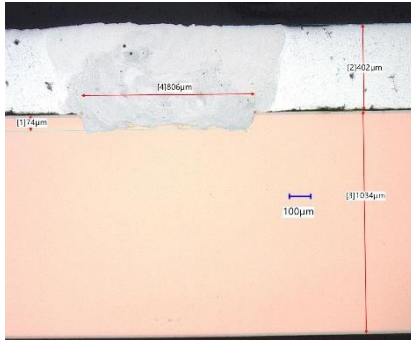
Project Contacts

- Contacts Al-Cu with different coatings
- Busbar Welding of Lithion Ion Batterypacks
- Goal: **Controlled** growth of the intermetallic phases in the weld seam

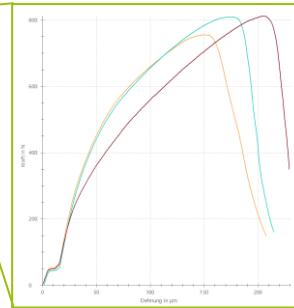
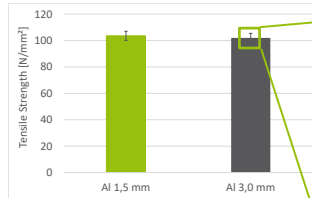


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Implementation LaVa-X



Development of Process & Clamping



Process Analyzation & Qualification



Stand Alone Production Machine or Module

