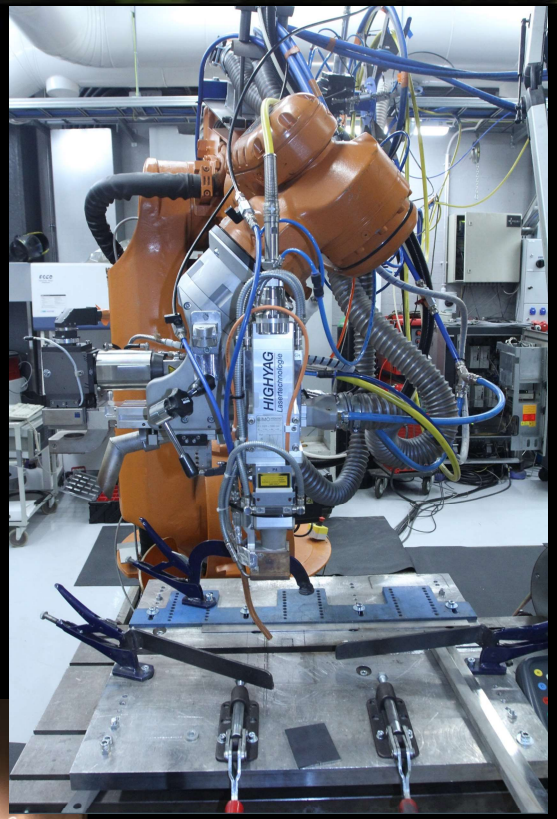
LUT LASER & AM

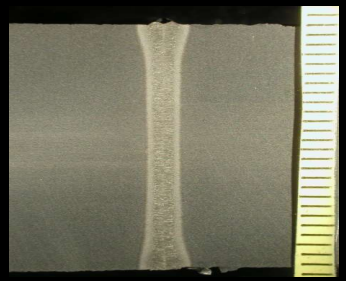
D.SC. ILKKA POUTIAINEN

- Historia
- Tutkimus
- Opetus / koulutus
- Tulevaisuus

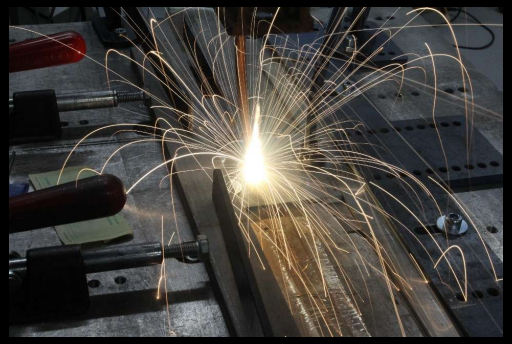
LASER WELDING

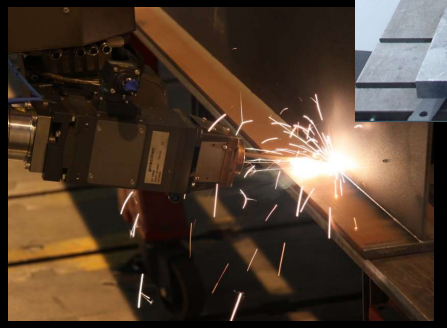
- Experimental research since 1985
- Teaching from 1990
- Scale from micro to meters
- Experience in CO2-, Fiber-, ND-YAG ja diode lasers
- Research topics:
  - Understanding of behaviour and features of Key-hole, filler wire, remote, and hybrid welding processes
  - Prosess monitorin since 2000
  - Product design for laser welding



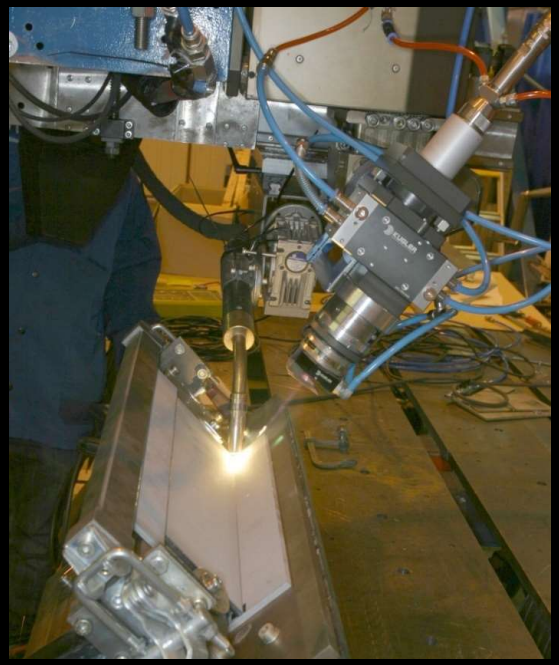


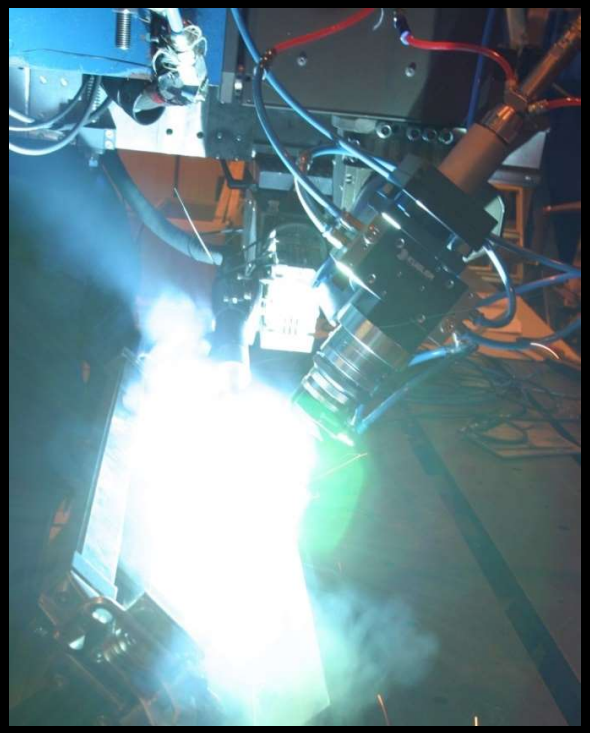
25 mm – 27 kW

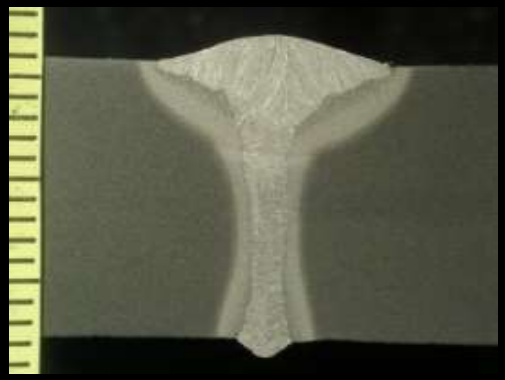


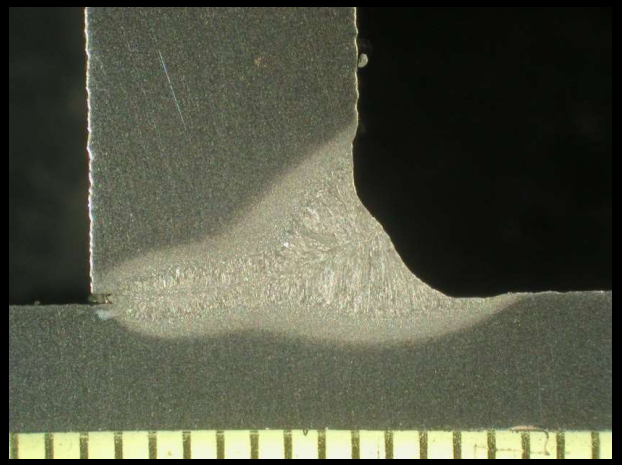


(LASER-ARC) **HYBRID WELDING**









SURFACE TREATMENTS

To improve surface properties. Adding corrosion -, wear - and heat resistance. Incresing hardness.

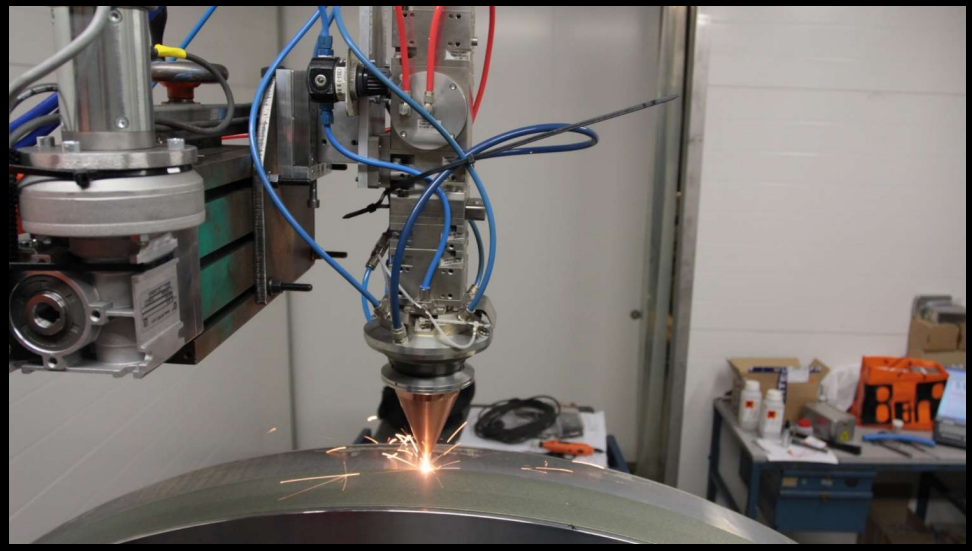
Surface treatments are

Laser quenching

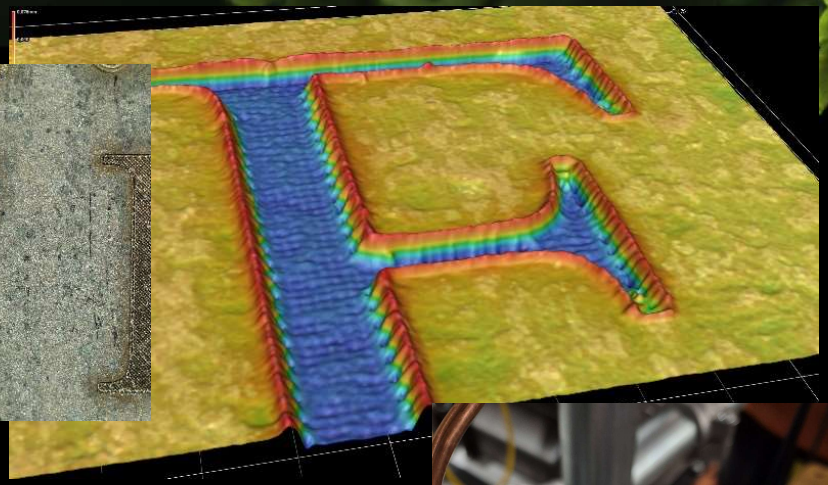
Laser cladding

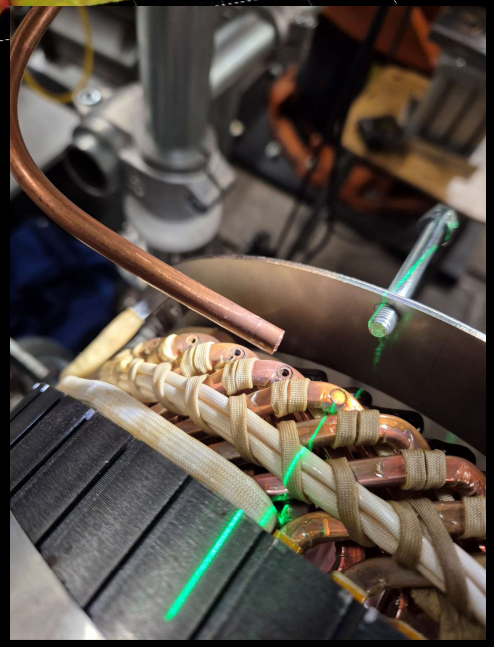
Laser surface melting

Laser alloying



LASER ENGRAVING AND MARKING





Different materials:

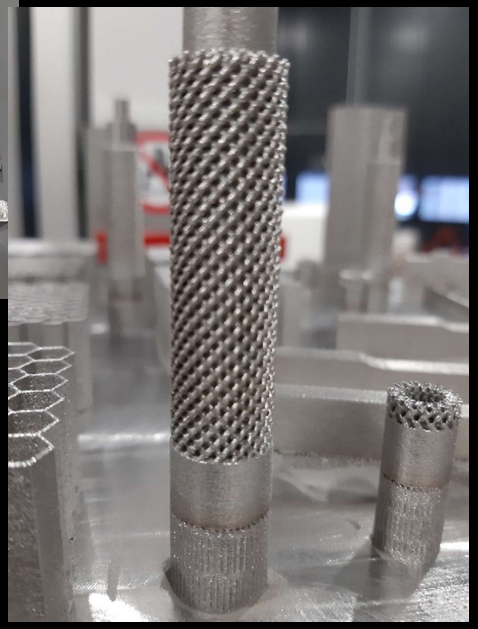
(Steel, plastics, wood etc.)

Equipment:

- Ns (pulsed laser)
- CW laser

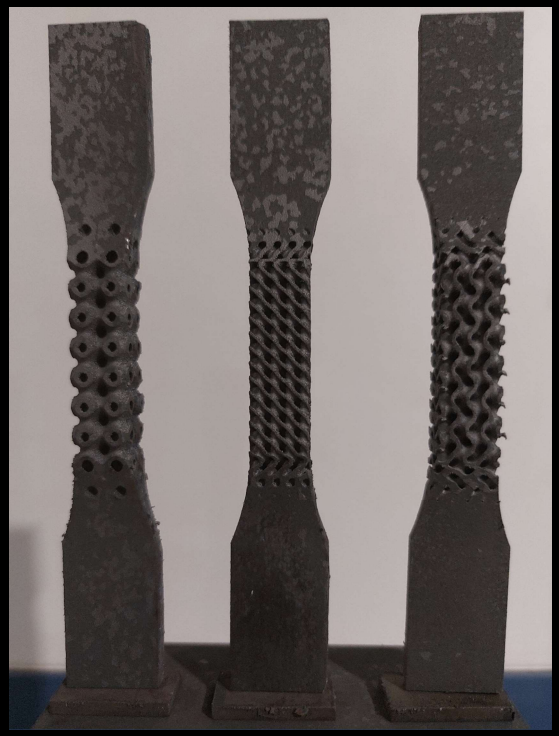
ADDITIVE MANUFACTURING (METAL 3D PRINTING)

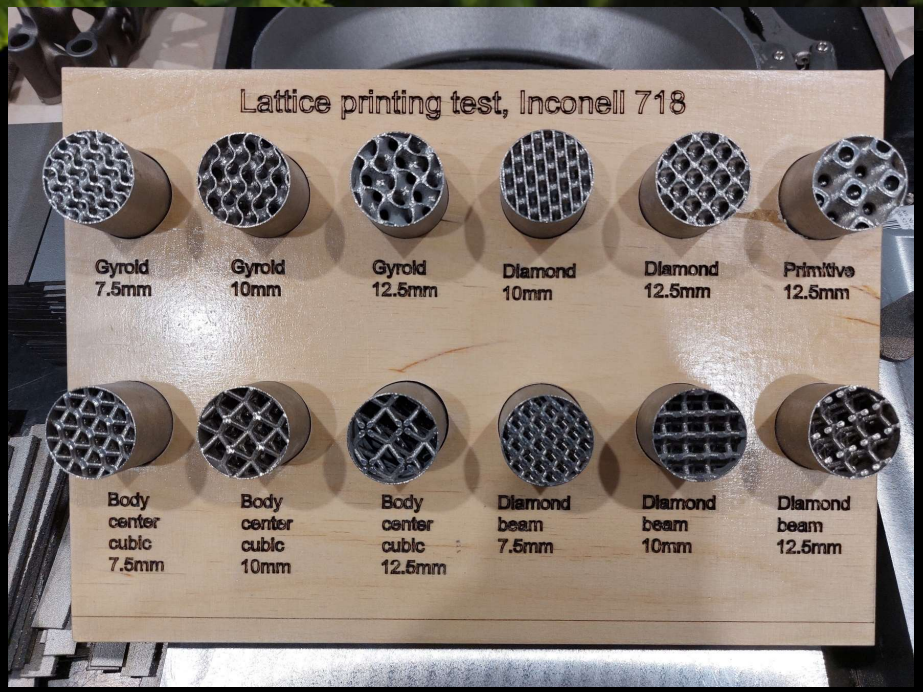
- Prosess monitoring 2009
- EOS M270 (2011), EOS M290 (2019)
- Topics
  - PBF and DED
  - Process improvement
  - Product development
  - Internal structures (lattice)
  - Mechanical properties
- Teaching started 2013



ADDITIVE MANUFACTURING (METAL 3D PRINTING)

- Current activity:
- Research on lattice strength
- Process monitoring



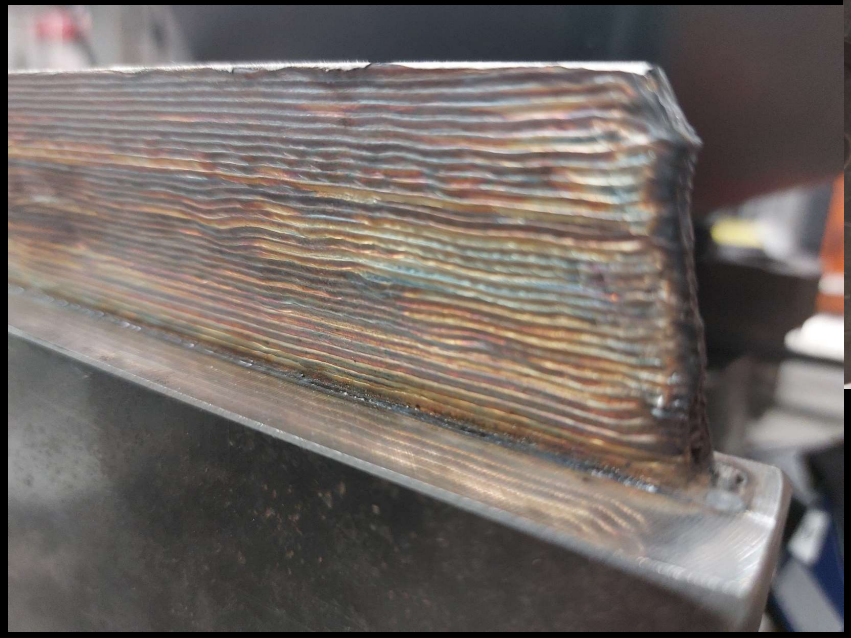


LASER-WIRE DED

10kW fiber laser

(rotating table and linear axel)

- Example 1mm autrod 12.50 travel speed 1m/min ja 0.5mm layers

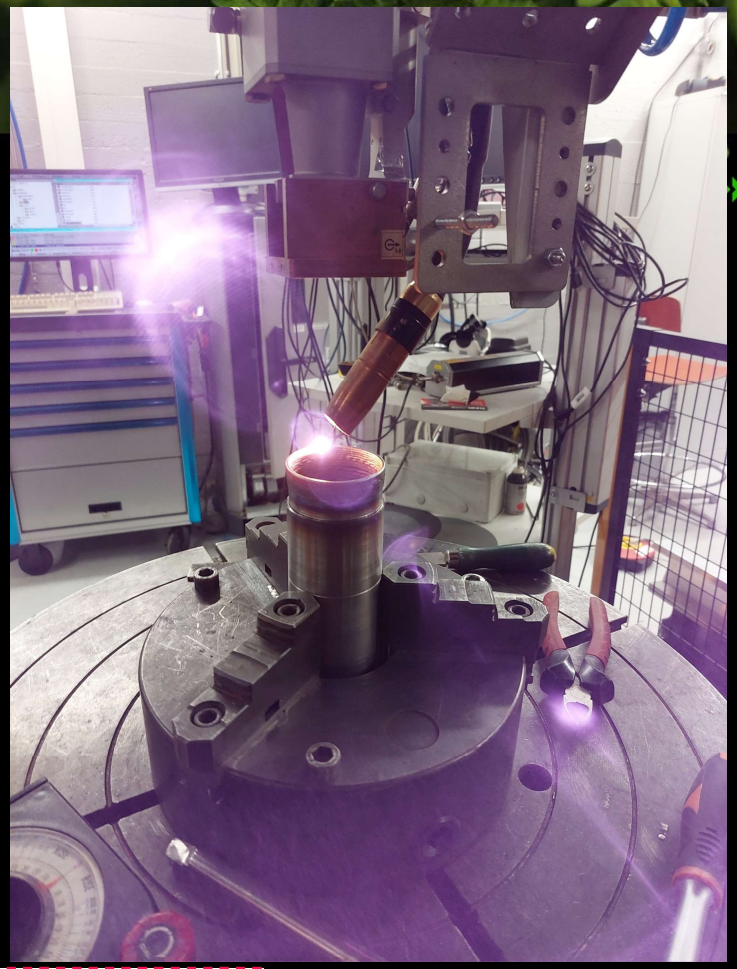


DED

ARC-DED (i.e., WAAM)

- Robot: ABB IRB 1600
- Power source: Fronius TransSteel 4000
- Filler material: OK AristoRod™ 12.63 (Ø 1.0 mm)

- Number of beads: 22
- Layer thickness: ~1.5 mm per bead
- Wall thickness: ~5 mm
- Run time: ~35 s per bead
- Interpass/cooling time: ~60 s per bead
- Total time: ~35 min



ARC vs. LASER
- quality
- productivity
- properties
- geometry
- …

LASER-DED

- Robot: KUKA KR30 R2100
- Power source: Fronius TransPuls Synergic 50
- Filler material: OK AristoRod 12.50

- Number of beads: 20
- Layer thickness: ~0.5mm
- Wall thickness: ~2mm
- Run time: ~15s bead
- Interpass/cooling time: NA
- Total time: ~6 min

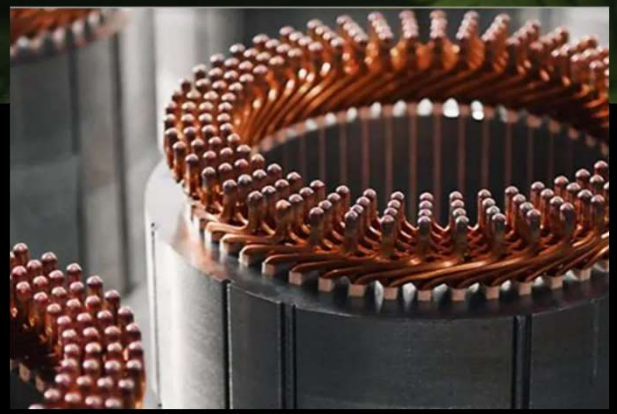
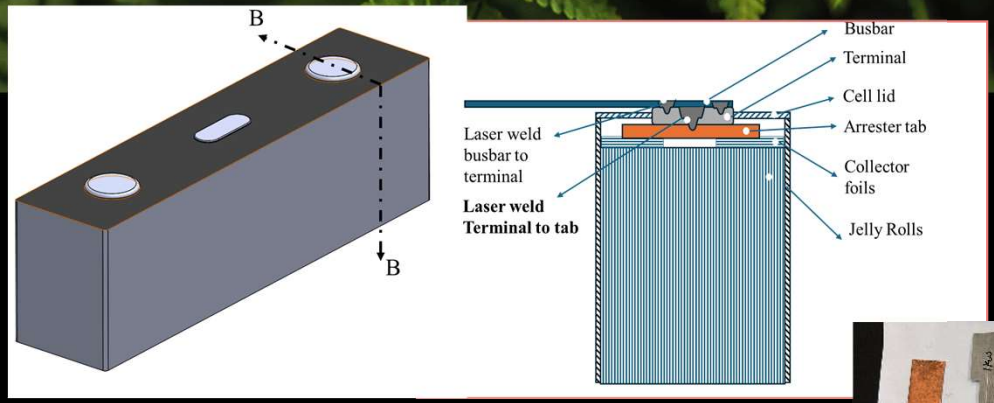
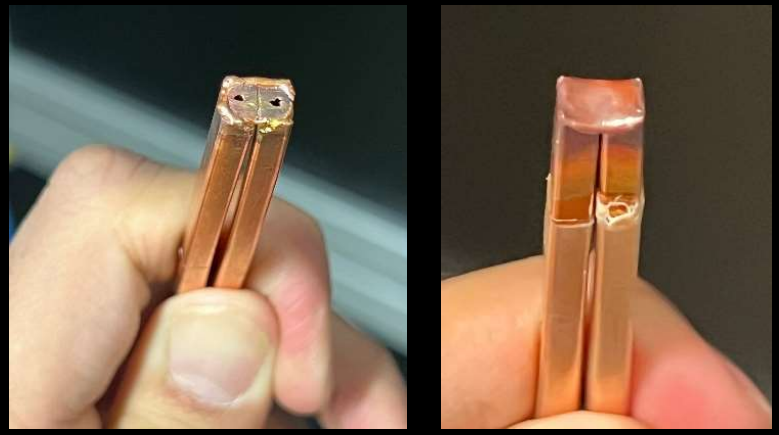


Image from Web



Al-Al welds for battery applications
Example: Al busbar + Al Casing for cells (Bachelor thesis)



Hairpin welds for electric motor applications (preleminary)

Al to Cu bus bar welds
(Doctoral studies)

Images by LUT Laser&AM

E-LIIKKUVUUDEN KEHITTYNEET VALMISTUSMENETELMÄT (ELIKEVA)

- Hankkeessa lisätään teollisuuden **tietoisuutta** digitaalisten valmistusmenetelmien, **kuten laserhitsaus ja -kaiverrus, mahdollisuuksista, sovelluskohteista ja koulutetaan** uusia osaajia teknologian hyödyntämiseen.
- Hankekokonaisuuteen kuuluu **E-liikkuvuuden kehittyneet valmistusmenetelmät** (Elikeva) -kehitys- ja investointihanke
- Hankkeen aikana otettiin käyttöön uusi lasertyöstölaite (Trumpf Trufiber 6000 P), jonka avulla voidaan ratkaista vaativia valmistusteknisiä ongelmia liittyen mm. sähköisten kulkuneuvojen komponentteihin
- Hankkeen kesto: 1.4.2024-31.12.2026
- Projektin rahoitus: Oikeudenmukaisen siirtymän rahasto (JTF), Lappeenrannan kaupunki ja LUT-yliopisto

Haasta meidät ja ilmoita ideasta. Katsotaan keksitäänkö jotain uutta ja mullistavaa!

Euroopan unionin osarahoittama