



MAGYAR HEGESZTÉSTECHNIKAI ÉS ANYAGVIZSGÁLATI EGYESÜLÉS
UNGARISCHE VEREINIGUNG FÜR SCHWEISSTECHNIK UND MATERIALPRÜFUNG
HUNGARIAN ASSOCIATION OF WELDING TECHNOLOGY AND MATERIAL TESTING

The situation of welding education and research in Hungary

Dr. habil. Marcell Gáspár



Hungarian Association of Welding Technology and Material Testing (MHTE)





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Content

- ✓ European and international qualifications
- ✓ International projects of MHTE
- ✓ Recent research topics:
 - Budapest University of Technology and Economics
 - Óbuda University
 - University of Miskolc
- ✓ Summary of recent research topics





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Education - Institutes





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Education - International level

- ✓ EWE/IWE: European/International Welding Engineer
- ✓ EWT/IWT: European/International Welding Technologist
- ✓ EWS/IWS: European/International Welding Specialist
- ✓ EWP/IWP: European/International Welding Practitioner
- ✓ EW/IW: TIG, MMA, MIG/MAG European/International Welder
- ✓ EWIP/IWIP: European/International Welding Inspector (basic, standard, comprehensive)
- ✓ IWSD: International Welded Structures Designer





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Education – European level

- ✓ EWP-RW: European Welding Practitioner for Resistance Welding
- ✓ EWS-RW: European Welding Specialist for Resistance Welding
- ✓ EAB: European Adhesive Bonder (prior authorization)
- ✓ EAS: European Adhesive Specialist (under extension)
- ✓ EAE: European Adhesive Engineer (under finalization)





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Education – Number of diplomas

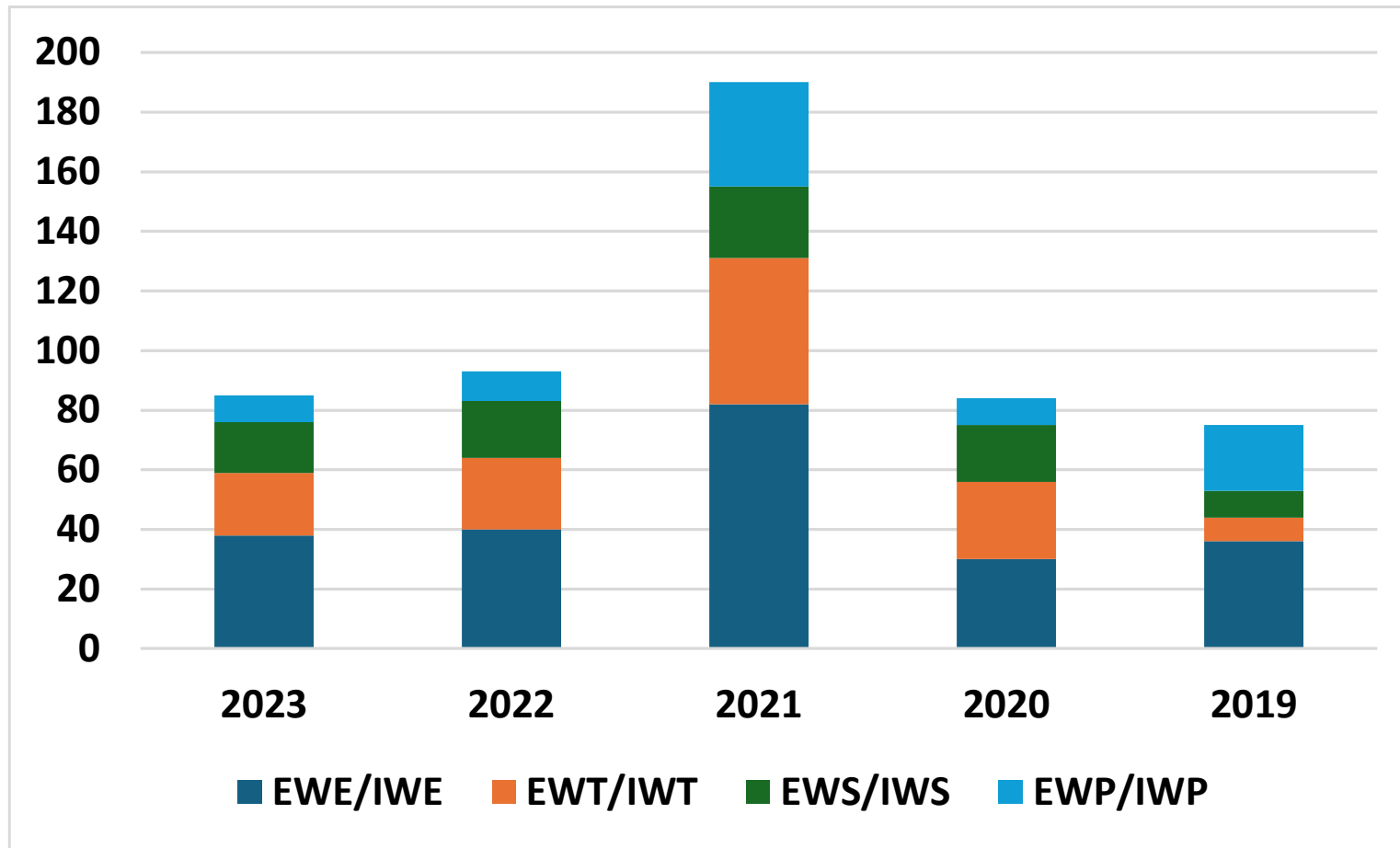
	2023	2022	2021	2020	2019
EWE/IWE	38	40	82	30	36
EWT/IWT	21	24	49	26	8
EWS/IWS	17	19	24	19	9
EWP/IWP	9	10	35	9	22
EWIP-B	20				13
EWIP-C	0		21		14
EWIP-S	0				
EW	12		11		12
EAB	50				
EAS	9				
EWP-RV		10			
EWS-RV		1			





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Education – Number of diplomas





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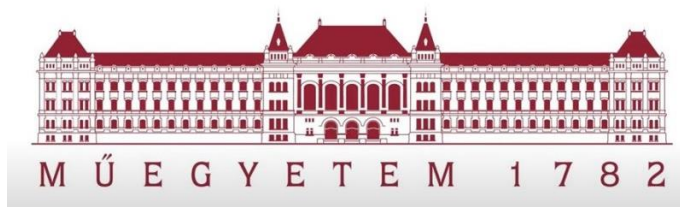
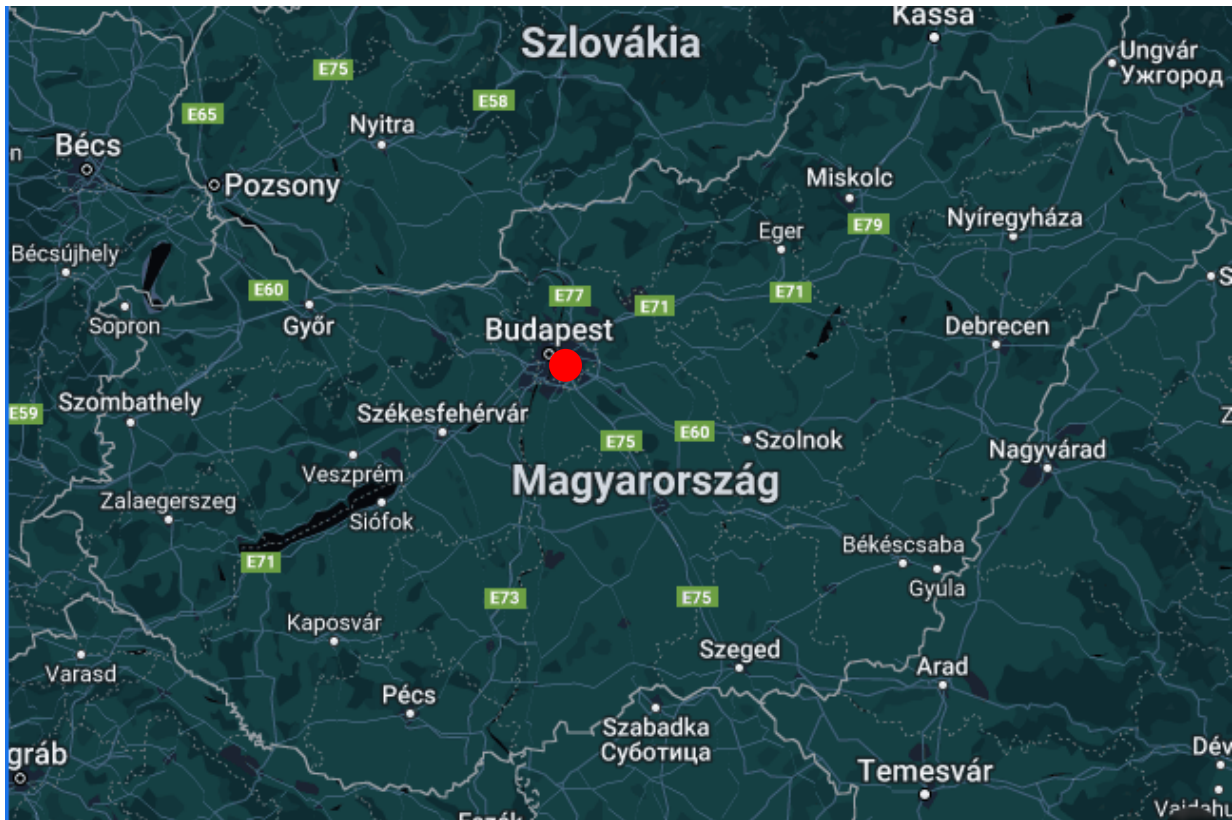
International projects

- ✓ BET (finished)
- ✓ EAGLE (finished)
- ✓ **IQVET: Innovative Quality VET Professional Teacher Training Program for Integration and Deployment of Staffs „Silent Knowledge” within Digitalization of Manufacturing Processes**
- ✓ HIMACROW (finished)
- ✓ IQSIM2 (finished)
- ✓ **IQMET: New innovative methods in the training of welding inspectors for the quality life cycle capacity processes used in production**





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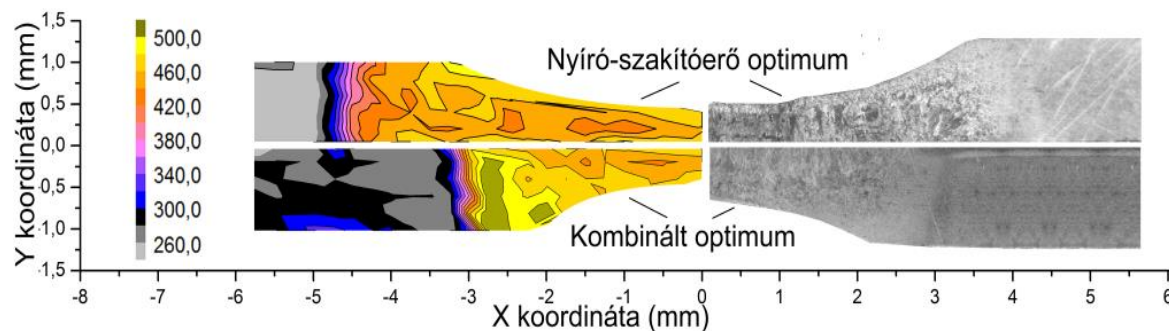
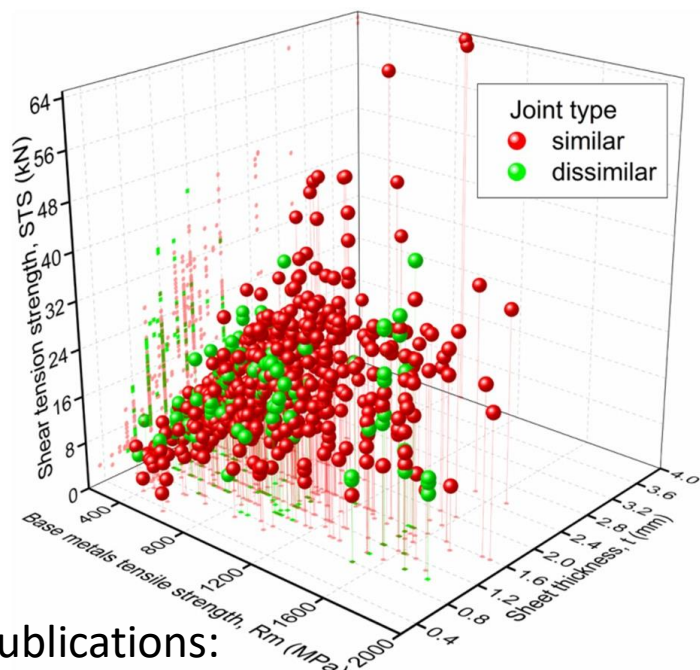
Budapest University of Technology and Economics

Faculty for Mechanical Engineering

Department for Materials Science and Engineering



Research at BME Department for Materials Science and Engineering - RSW of ultra high strength steels



Contact:

Kornél Májlinger,

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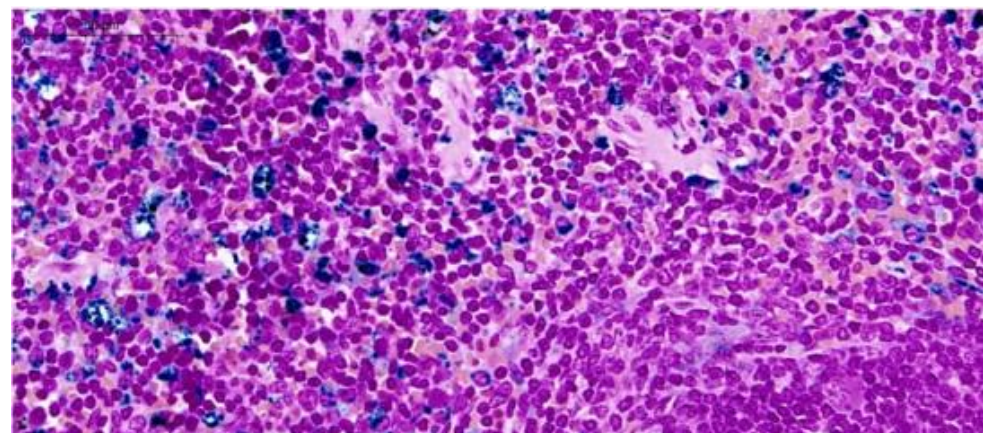
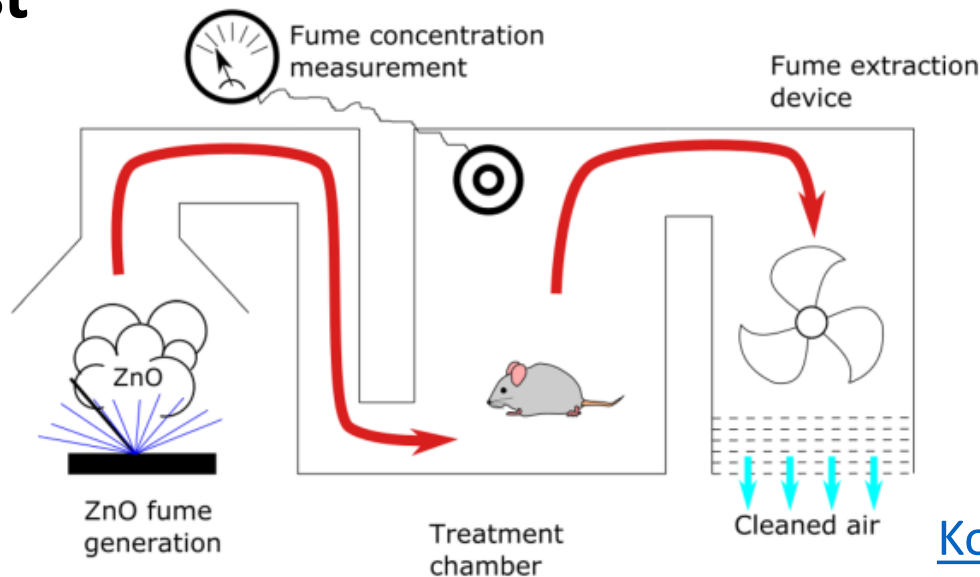
Publications:

- Májlinger, Kornél ; Katula, Levente T. ; Varbai, Balázs: Global Approach on the Shear and Cross Tension Strength of Resistance Spot Welded Thin Steel Sheets <https://doi.org/10.3311/PPme.23184>
- Májlinger, Kornél ; Katula, Levente T. ; Varbai, Balázs: Prediction of the Shear Tension Strength of Resistance Spot Welded Thin Steel Sheets from High- to Ultrahigh Strength Range <https://doi.org/10.3311/PPme.18934>
- Varbai, Balázs ; Sommer, Christina ; Szabó, Mihály ; Tóth, Tamás ; Májlinger, Kornél: Shear tension strength of resistant spot welded ultra high strength steels <https://doi.org/10.1016/j.tws.2019.04.051>

BME cooperation University of Veterinary Medicine Budapest



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Csaba Kővágó,
Kovago.Csaba@univet.hu



Publications:

- Kővágó, Csaba ; Májlinger, Kornél ; Szűcs-Somlyó, Éva; Lehel, József: Investigation on the effectivity of nanoparticle elimination of a fume extractor TIG torch <https://doi.org/10.1007/s40194-024-01741-5>
- Szucs-Somlyo, Eva ; Lehel, Jozsef ; Majlinger, Kornel ; Lorincz, Marta ; Kovago, Csaba: Metal-oxide inhalation induced fever-Immunotoxicological aspects of welding fumes <https://doi.org/10.1016/j.fct.2023.113722>
- Szűcs-Somlyó, É. ; Lehel, J.; Májlinger, K. ; Tóth, F. ; Jerzsele, Á. ; Kővágó, C.: Immune response to zinc oxide inhalation in metal fume fever, and the possible role of IL-17f <https://doi.org/10.1038/s41598-023-49430-5>

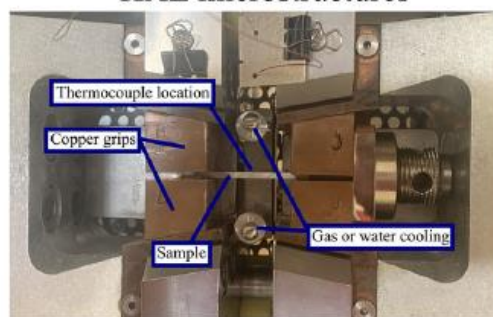


Research at Budapest University of Technology and Economics

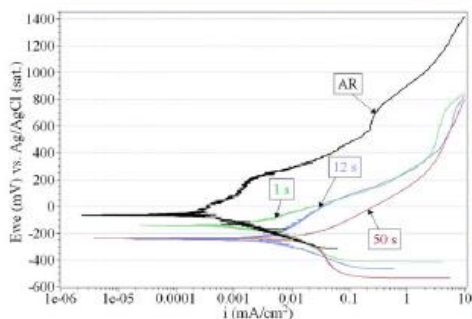
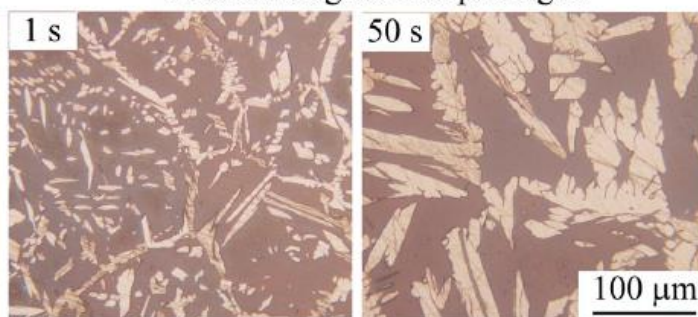
Weldability of duplex stainless steels

<https://doi.org/10.1007/s11665-023-08807-3>

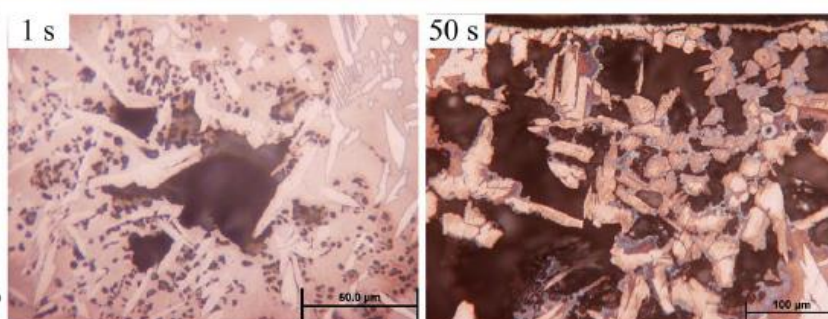
Gleeble simulations for different HAZ microstructures



Different cooling times result in different grain morphologies



Electrochemical corrosion test to evaluate HAZ resistance



Pitting corrosion initiated at the most susceptible microstructure



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WAAM



<https://doi.org/10.2478/adms-2023-0023>

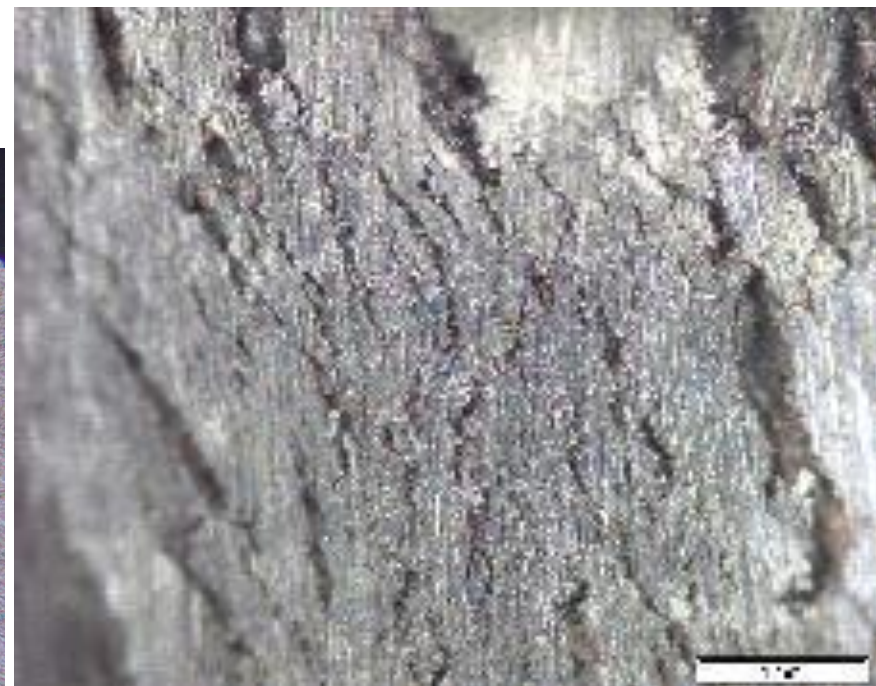
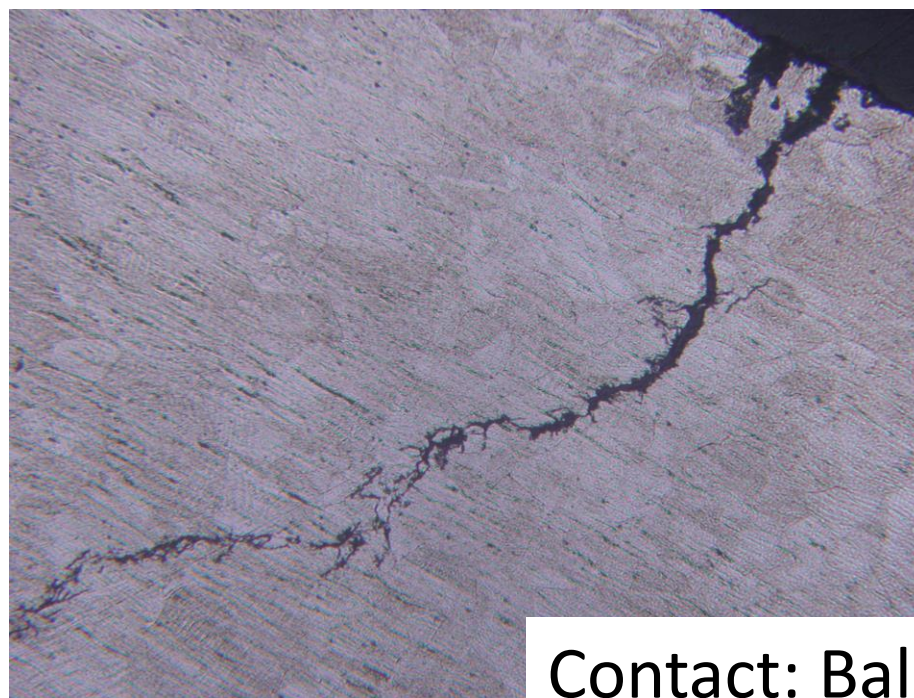
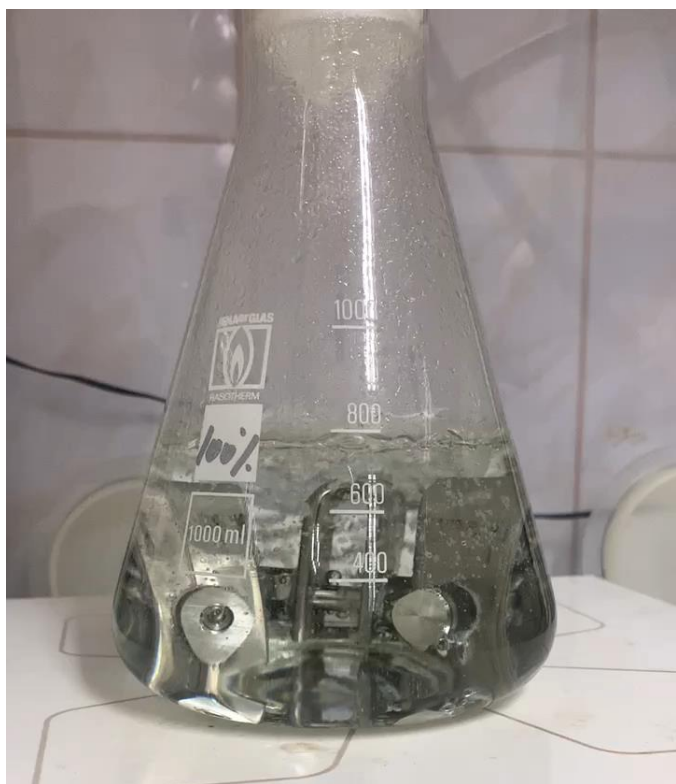


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Research at Budapest University of Technology and Economics - Corrosion testing of stainless steels

Stress and intergranular corrosion testing



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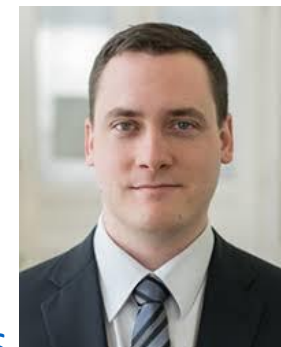


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Budapest University of Technology and Economics cooperation with Politechnika Gdańska

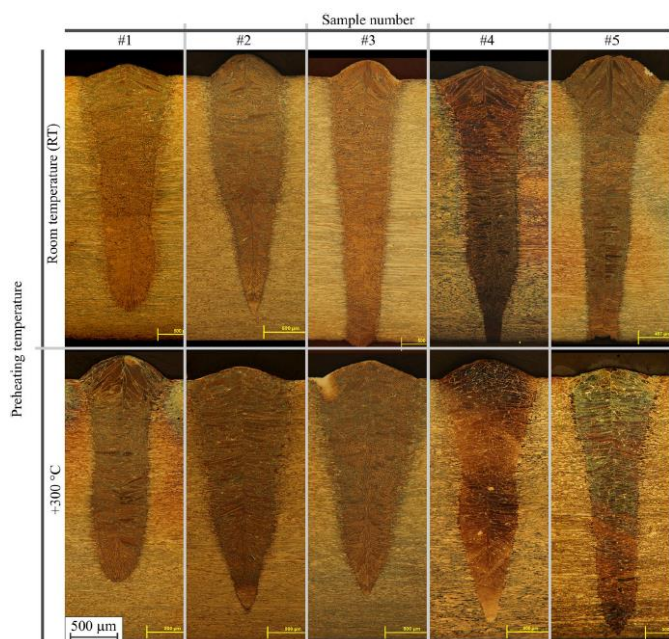
Publications:

- Michał Landowski · Soma Csaba Simon · Csaba Breznay · Dariusz Fydrych · Balázs Varbai: Effects of preheating on laser beam–welded NSSC 2120 lean duplex steel, <https://doi.org/10.1007/s00170-023-12840-w>
- Aleksandra Świerczyńska · Balázs Varbai · Chandan Pandey · Dariusz Fydrych: Exploring the trends in flux-cored arc welding: scientometric analysis approach, <https://doi.org/10.1007/s00170-023-12682-6>



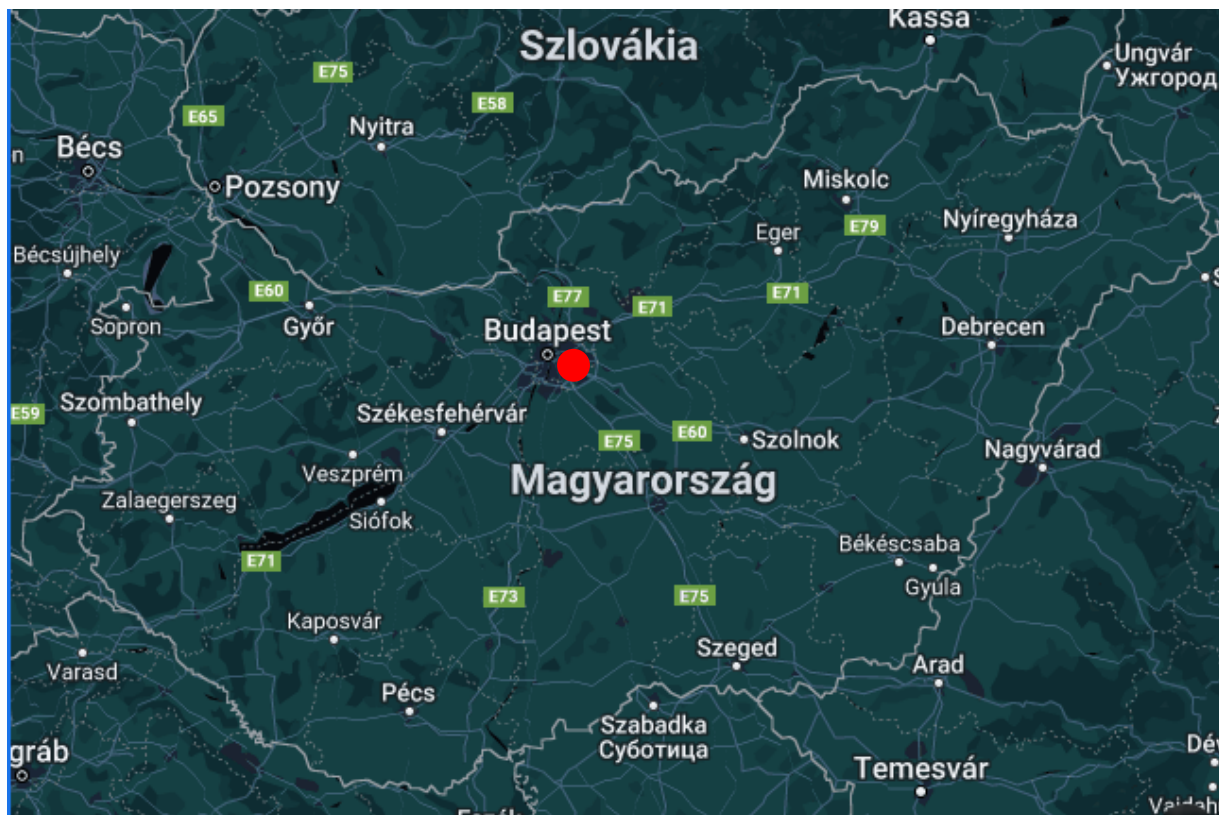
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ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

Óbuda University

Bánki Donát Faculty of Mechanical and Safety Engineering





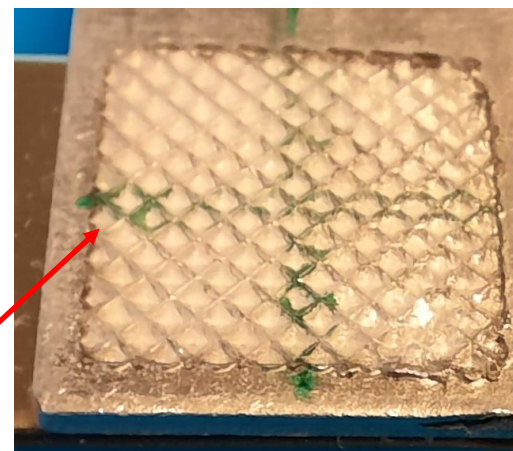
Tünde Kovács
kovacs.tunde@bgk.uni-obuda.hu

Ultrasonic Welding of metals and polymers

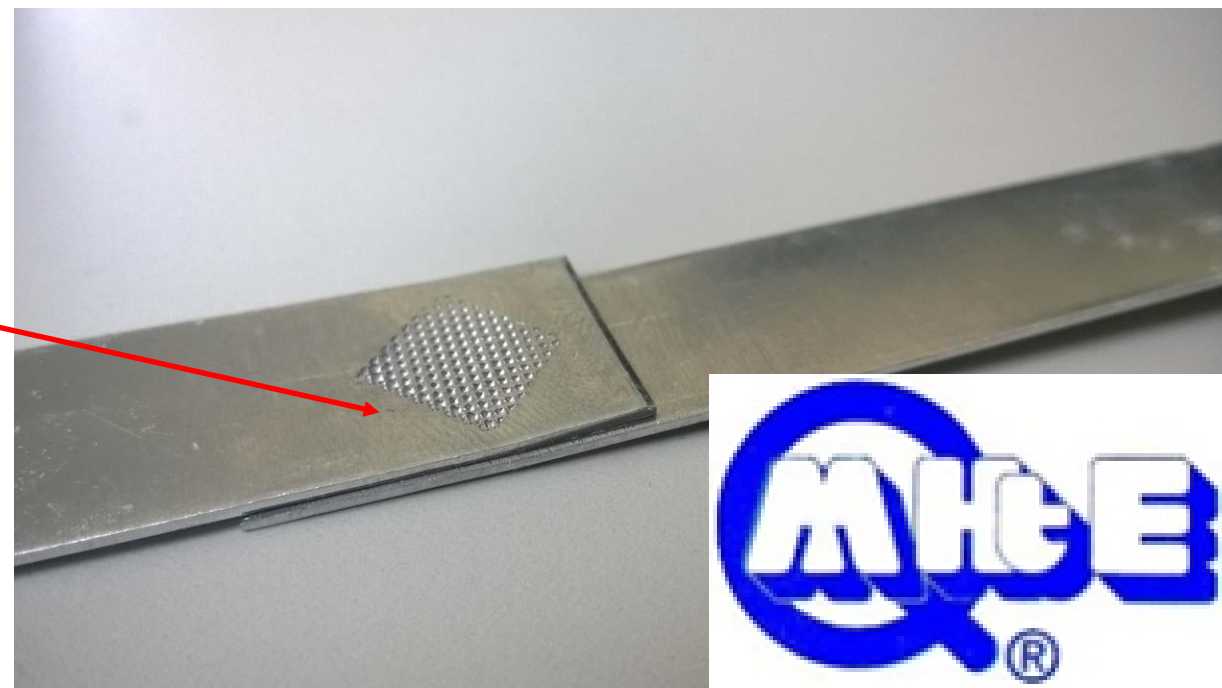


Polimer bumper component

Battery parts



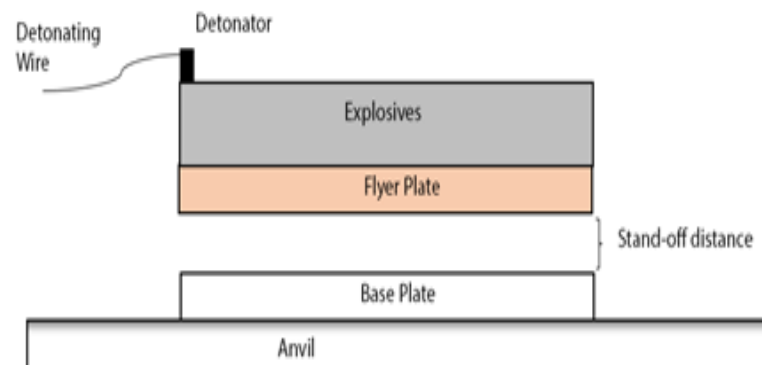
Vehicle control unit
Faraday covers



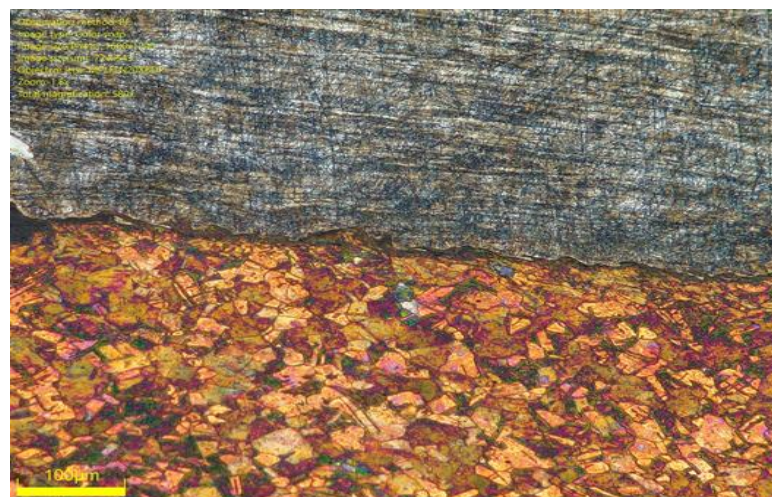
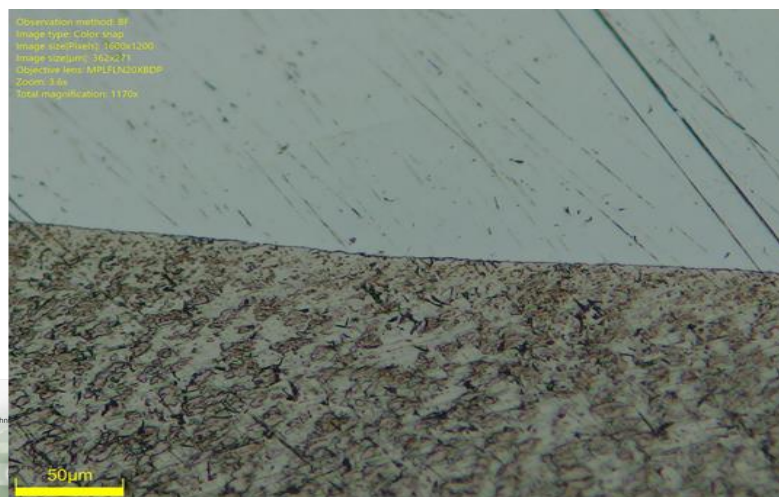
Explosive welding

The explosive welding with parallel setup.

Titanium and stainless steel



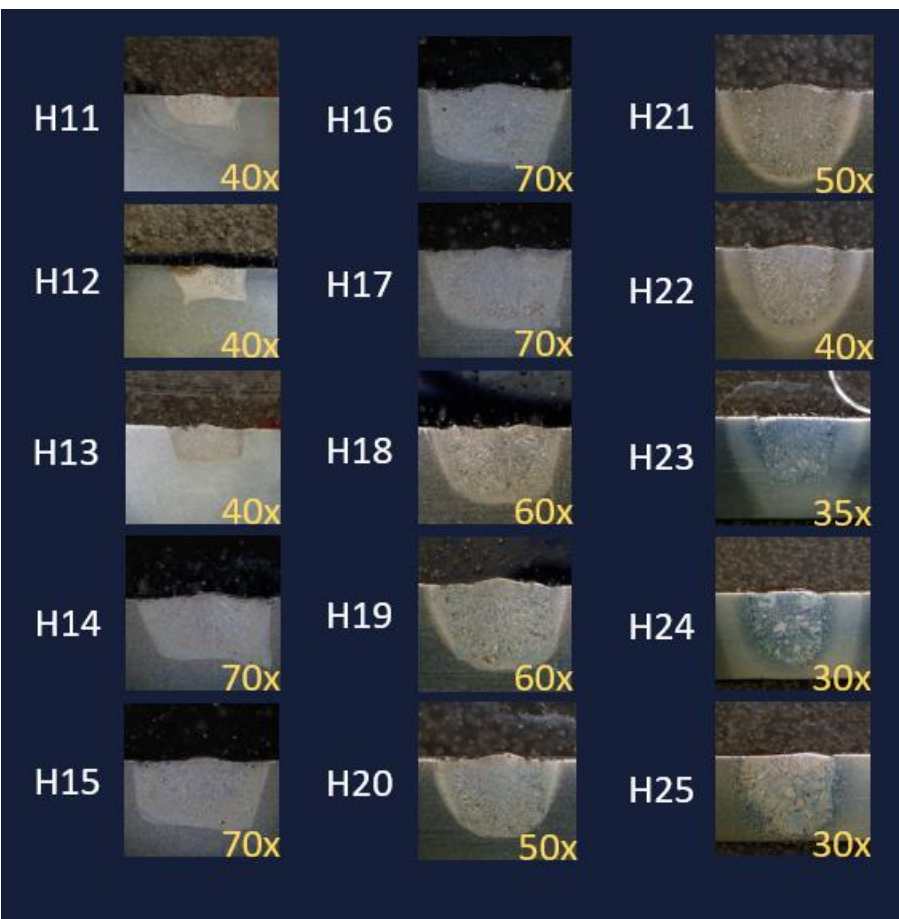
Copper and stainless steel





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Laser welding / manual Laser welding

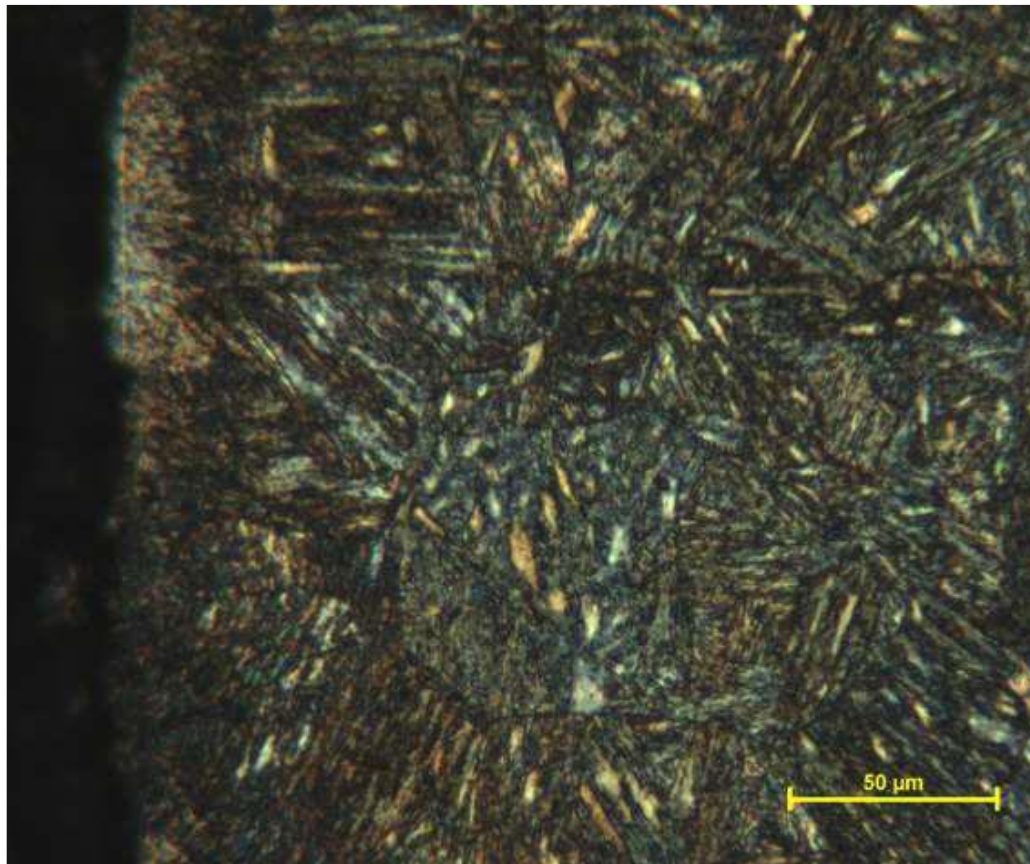




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High-strength steel welding and cutting

- S960Q steel oxy-fuel cutting
- Experimental study to determine the preheating conditions

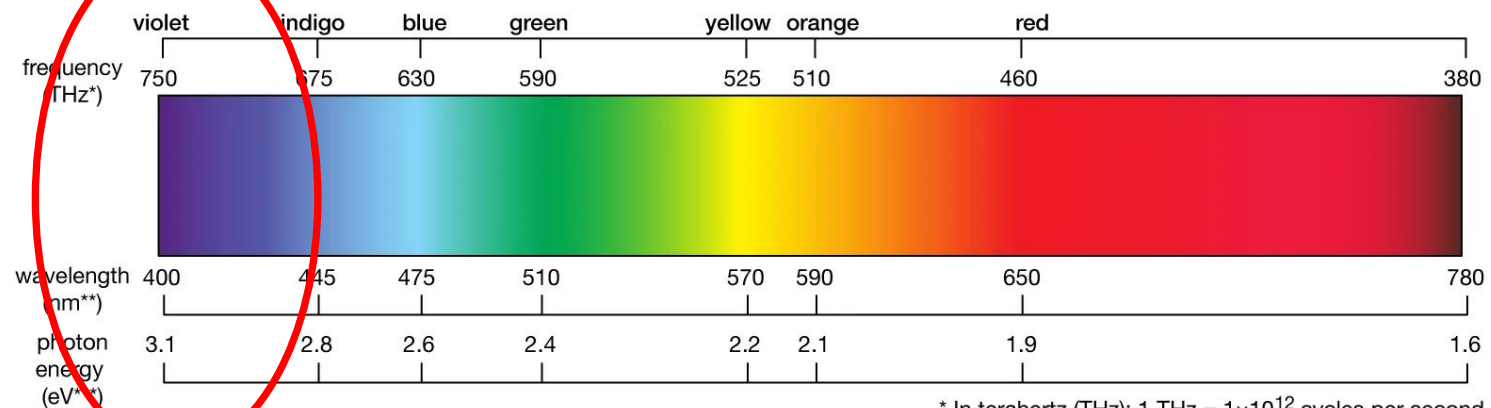




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Investigation of the arc welding shielding gases UV radiation level

Light, the visible spectrum



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* In terahertz (THz); 1 THz = 1×10^{12} cycles per second.
** In nanometres (nm); 1 nm = 1×10^{-9} metre.
*** In electron volts (eV).





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Publications:

Kertesz, Jozsef ; Kovács, Tunde Anna: Finite element analysis regarding folding behaviour of different crashbox versions EUROPEAN JOURNAL OF MECHANICS A-SOLIDS 107 pp. 1-16. Paper: 105375 , 16 p. (2024) <https://doi.org/10.1016/j.euromechsol.2024.105375>

Kónya, János; Hassanen, Jaber; Kovács, Tünde Anna; Hargitai, Hajnalka: Effects of selective laser melting building directions and surface modifications on surface roughness of Ti6Al4V alloy, DISCOVER APPLIED SCIENCES 6 : 1 Paper: 5, 8 p. (2024) <https://doi.org/10.1007/s42452-024-05656-0>

Schramkó, Márton ; Pinke, Péter ; Kovács, Tünde Anna: Examination of UV Radiation During Inert Gas Arc Welding In: Kovács, Tünde Anna; Nyikes, Zoltán; Berek, Tamás; Daruka, Norbert; Tóth, László (szerk.) Critical Infrastructure Protection in the Light of the Armed Conflicts Cham, Svájc : Springer Nature Switzerland AG (2024) 534 p. pp. 9-18. Paper: Chapter 2 , 10 p. https://doi.org/10.1007/978-3-031-47990-8_2





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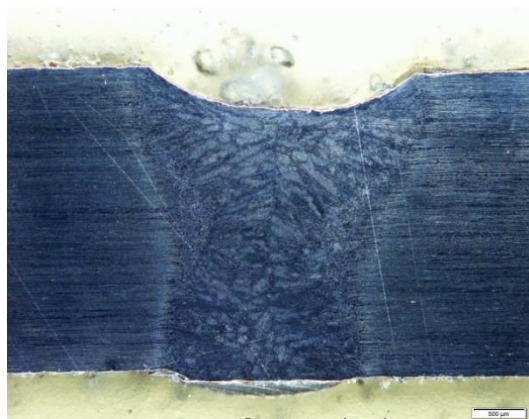
22/49

Contact:

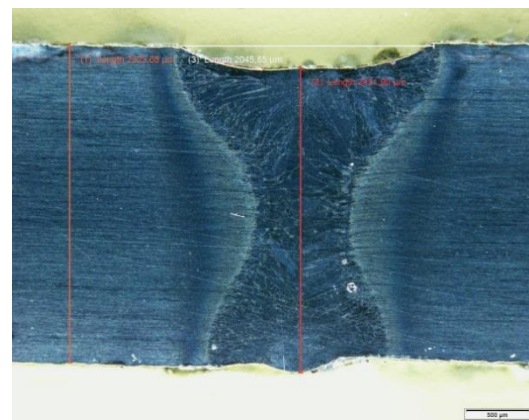
Enikő Réka Fábián
fabian.reka@bgk.uni-obuda.hu

Laser welding of duplex stainless steels

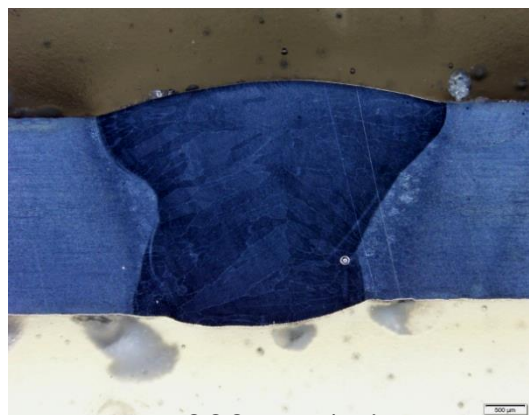
X2CrNiMnMoCuN24-4-3-2
// 2304//3mm



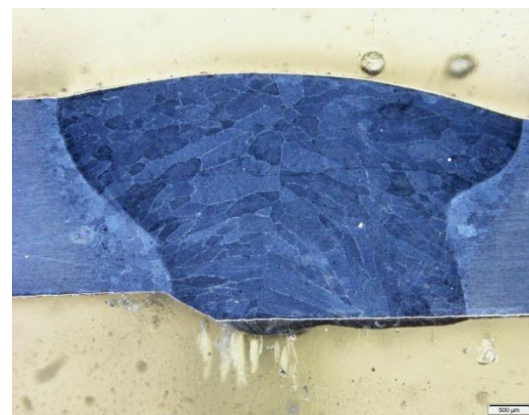
$v_{\text{laser}} = 750 \text{ mm/min}$



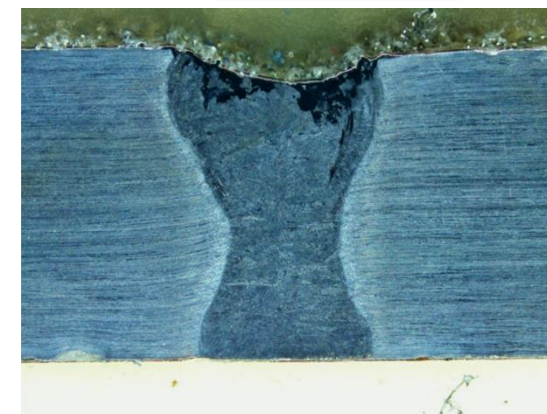
$v_{\text{laser}} = 1800 \text{ mm/min}$



$v_{\text{wire}} = 1000 \text{ mm/min}$
 $v_{\text{laser}} = 500 \text{ mm/min}$



$v_{\text{wire}} = 1000 \text{ mm/min}$
 $v_{\text{laser}} = 350 \text{ mm/min}$



$v_{\text{powder}} = 14 \text{ g/min}$
 $v_{\text{laser}} = 900 \text{ mm/min}$

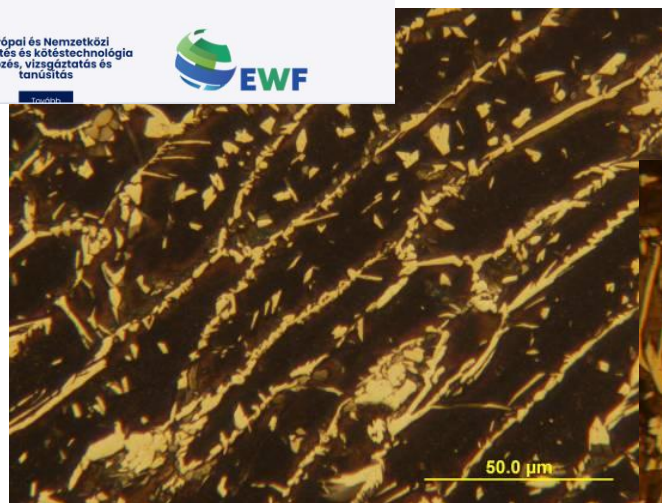




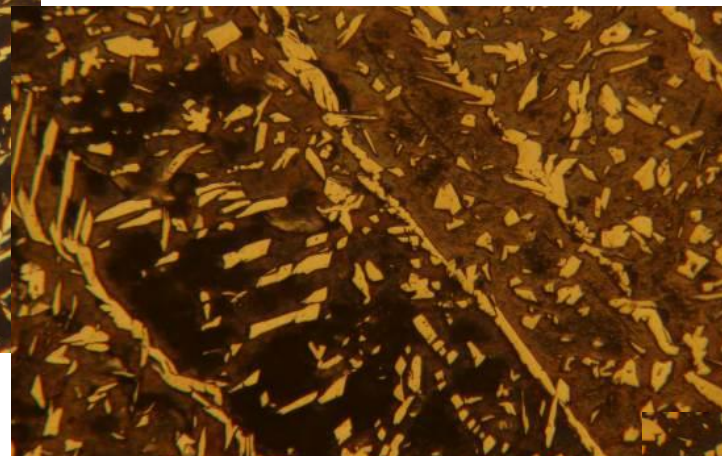
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Effect of welding speed on ferrite content

$v_{\text{laser}} = 1500 \text{ mm/min}$

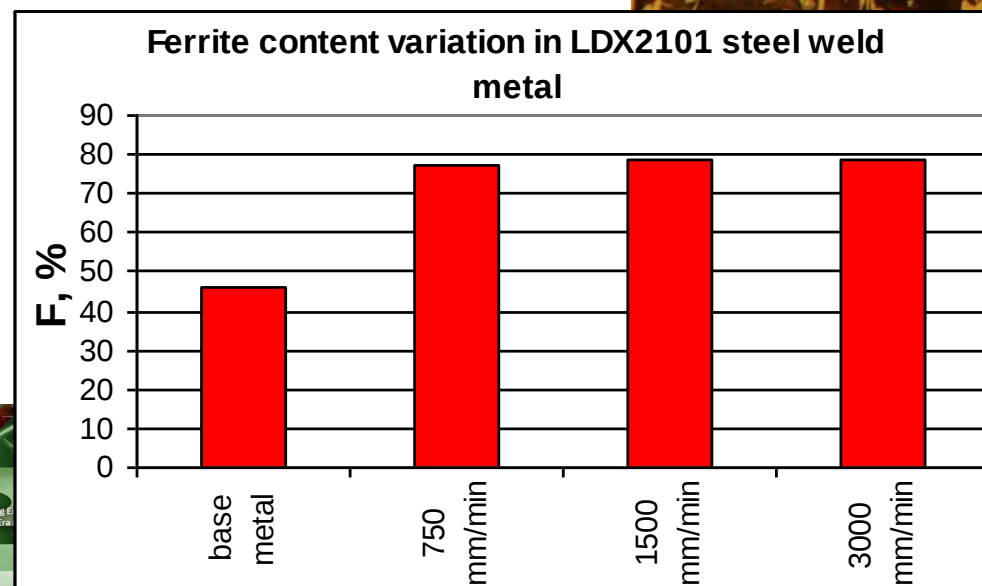
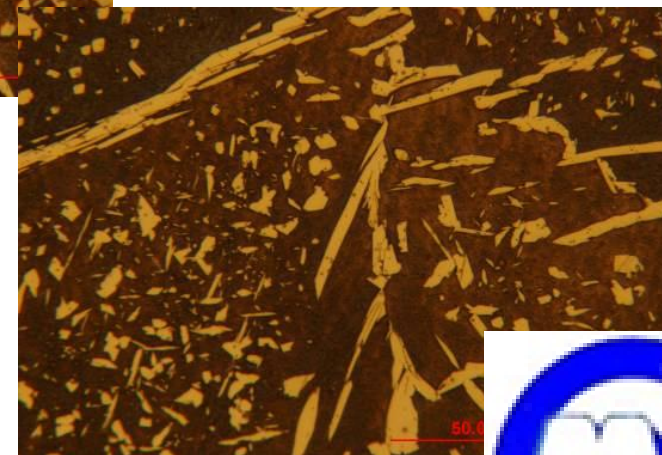


$v_{\text{laser}} = 3000 \text{ mm/min}$



X3CrMnNiN 21-5-1 //
2101//1,5 mm

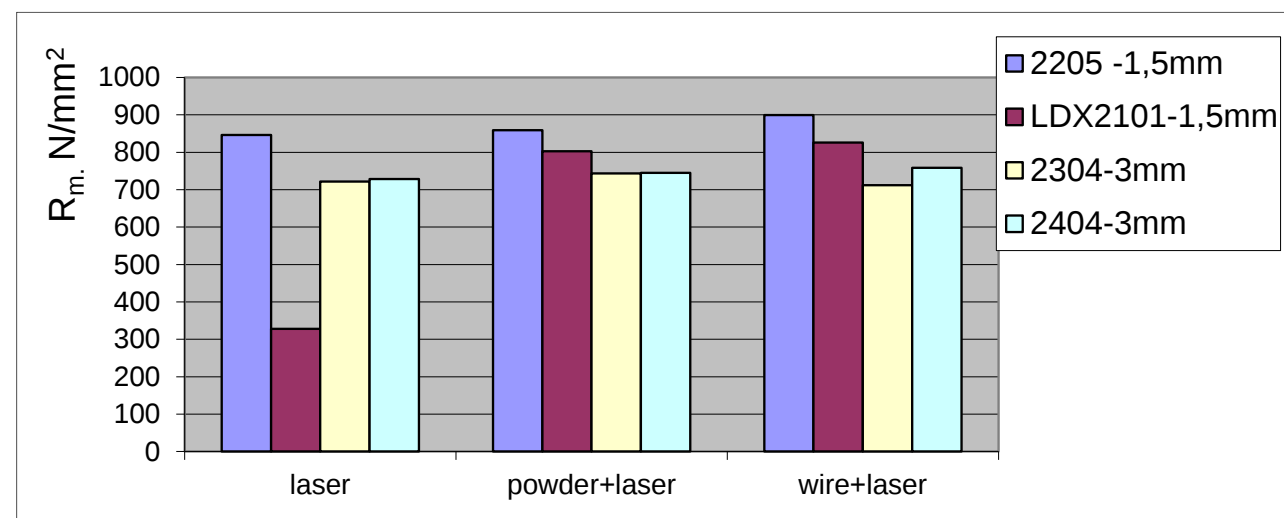
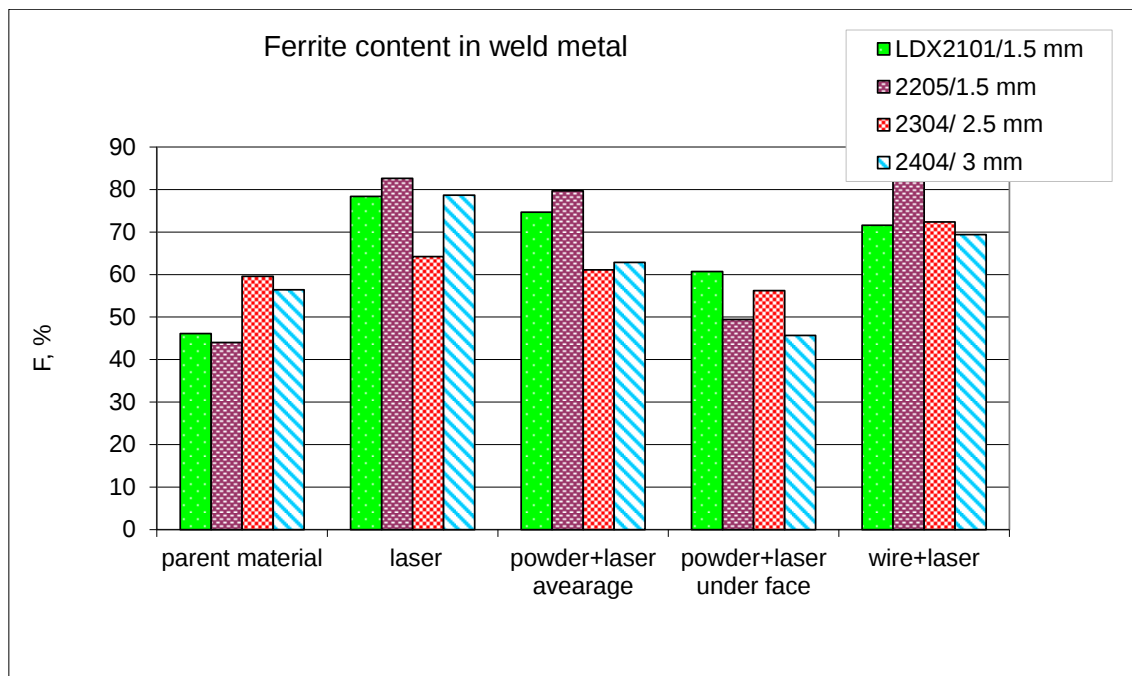
$v_{\text{laser}} = 750 \text{ mm/min}$





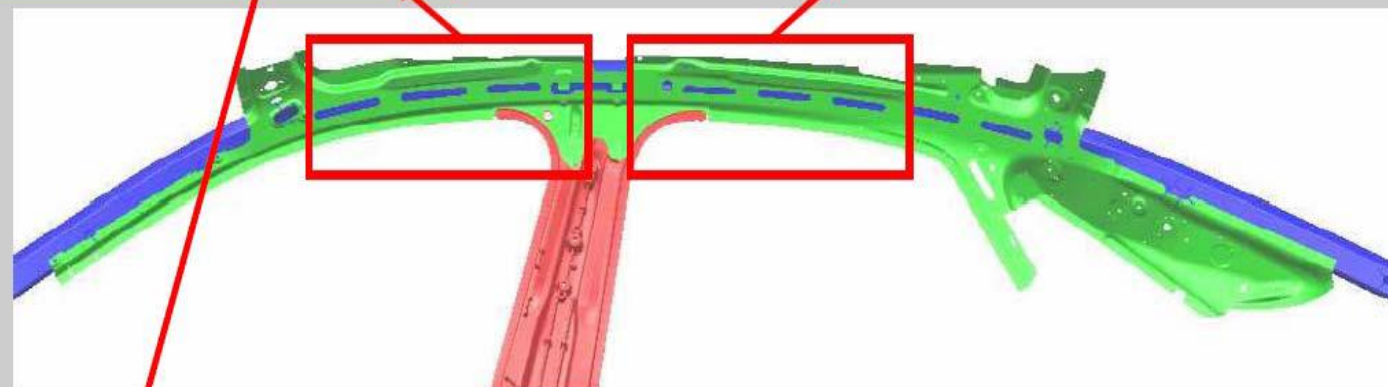
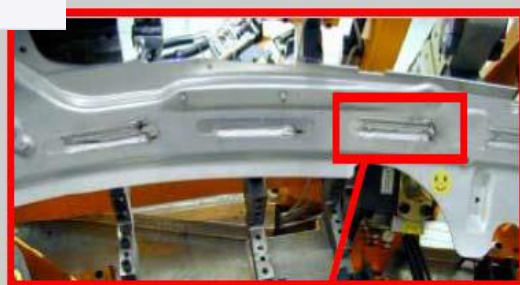
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Effects of welding parameters





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- Laser power: $P_L = 3,4 \text{ kW}$
- welding speed: $V_c = 3,6 \text{ m/min}$

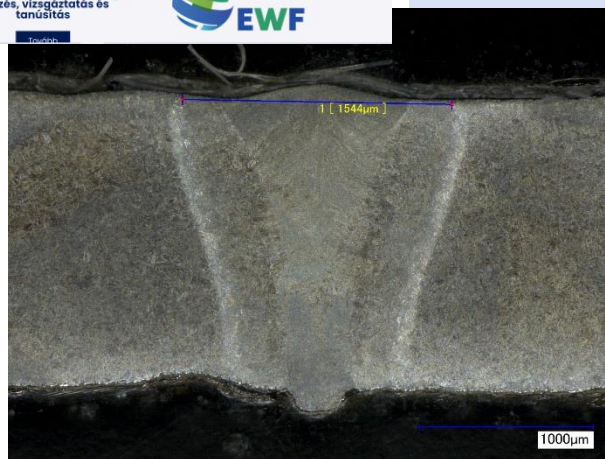




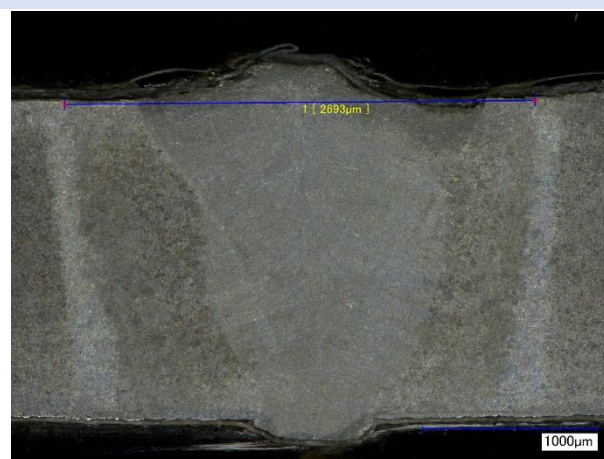
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C	Si max.	Mn max.	P max.	S max.	Al	Cr max.	Ti + Nb max.	B
0.20 – 0.25	0.5	2.0	0.02	0.005	0.02 – 0.10	0.5	0.05	0.002 – 0.005

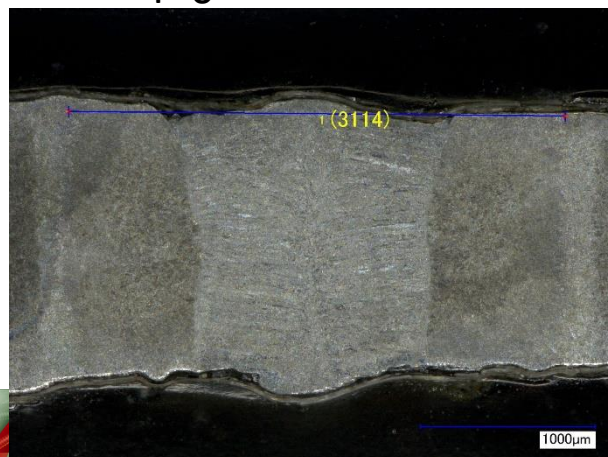
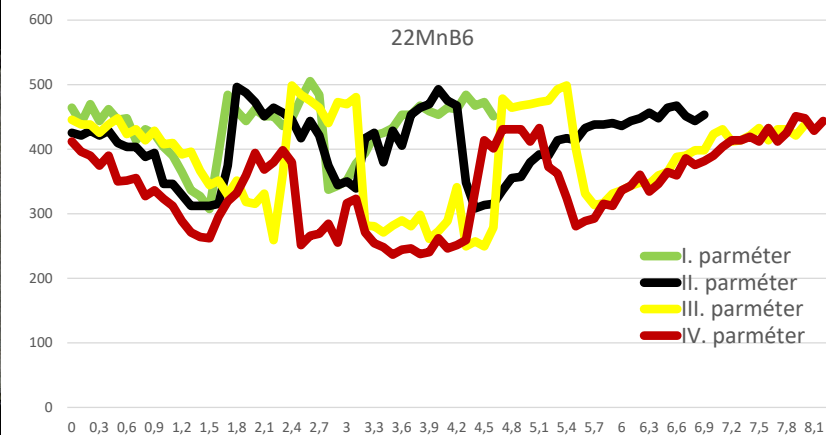
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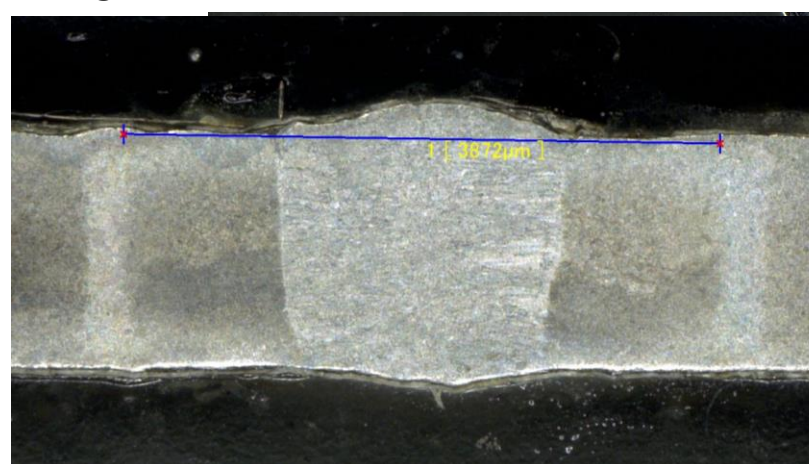
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 $f=+7,5$



$v=1050\text{mm/min}$,
 $f=+10$
fabian.reka@bgk.uni-obuda.hu





MAGYAR HEGESZTÉSTECHNIKAI ÉS ANYAGVIZSGÁLATI EGYESÜLÉS
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 HUNGARIAN ASSOCIATION OF WELDING TECHNOLOGY AND MATERIAL TESTING

Publications:

Tóth, L. ; Fábián, R.E. ; Pinke, P. ; Kovács, T.A. ; Nabiałek, M. ; Sandu, A.V. ; Vizureanu, P.

Comparison of the Properties of Cold Work Tool Steels with the Same Hardness but Different Manufacturing Processes The required important properties, ARCHIVES OF METALLURGY AND MATERIALS 69 : 3 pp. 809-817. , 9 p. (2024)

<https://doi.org/10.24425/amm.2024.150900>

Réger, Mihály ; Gáti, József ; Oláh, Ferenc ; Horváth, Richárd; Fábián, Enikő Réka ; Bubonyi, Tamás

Detection of Porosity in Impregnated Die-Cast Aluminum Alloy Piece by Metallography and Computer Tomography

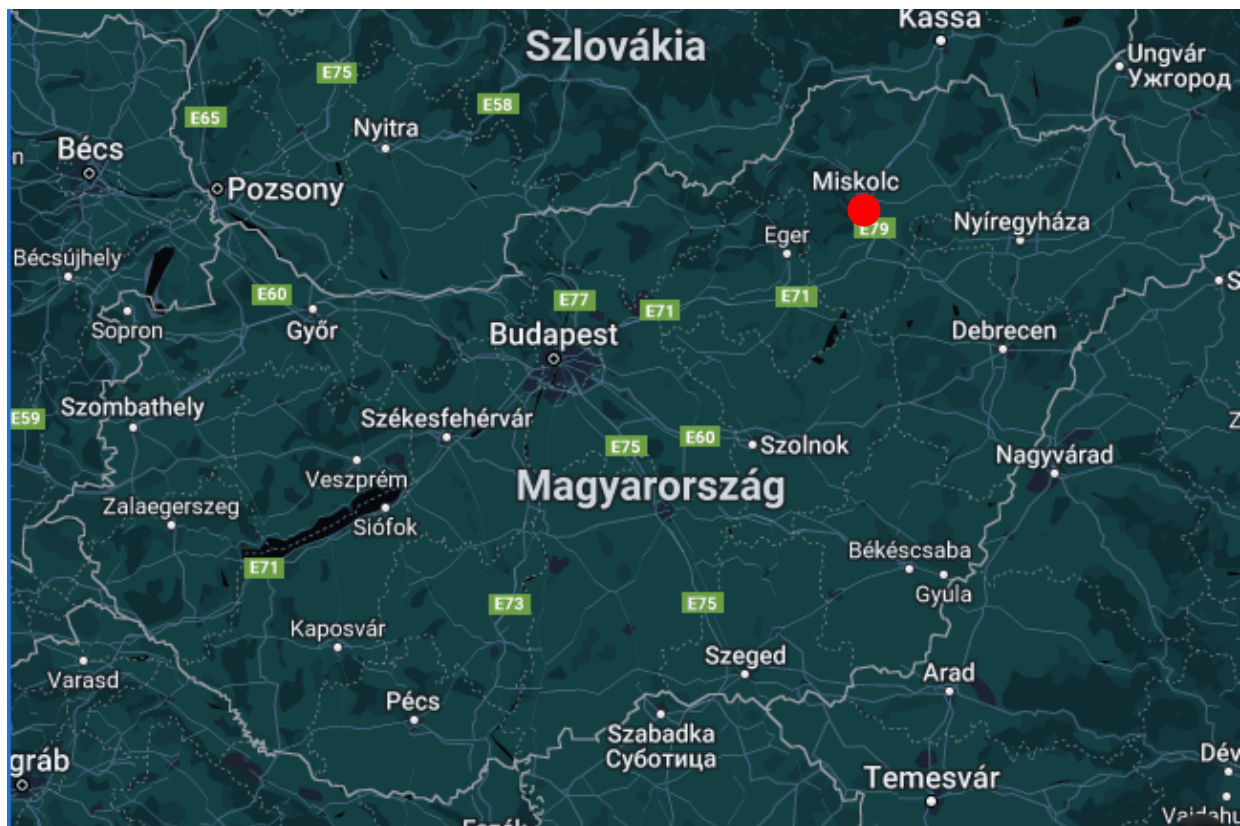
CRYSTALS 13 : 7 Paper: 1014 , 12 p. (2023) <https://doi.org/10.3390/cryst13071014>

FABIAN, ENIKO REKA ; KUTI, JANOS ; GATI, JOZSEF ; TOTH*, LASZLO: Corrosion Behavior of Welded Joints in Different Stainless Steels, REVISTA DE CHIMIE 71 : 3 pp. 440-449. , 10 p. (2020) <https://doi.org/10.37358/RC.20.3.8018>





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University of Miskolc

Faculty for Mechanical Engineering and Informatics

Institute of Material Science and Technology

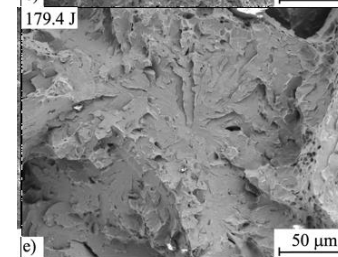
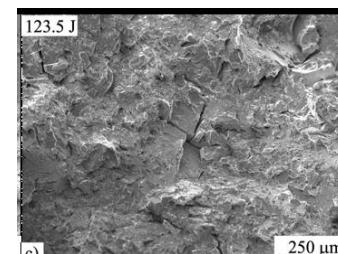
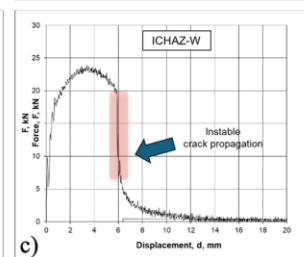
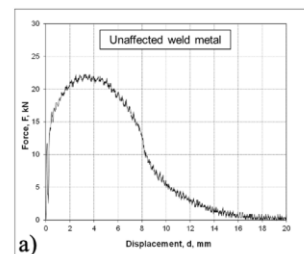
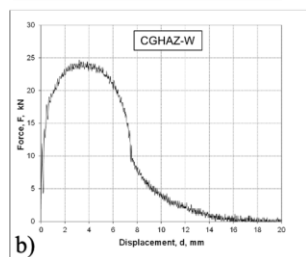
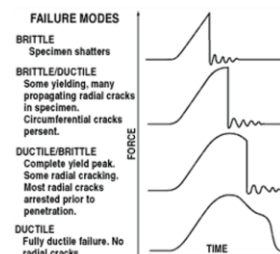
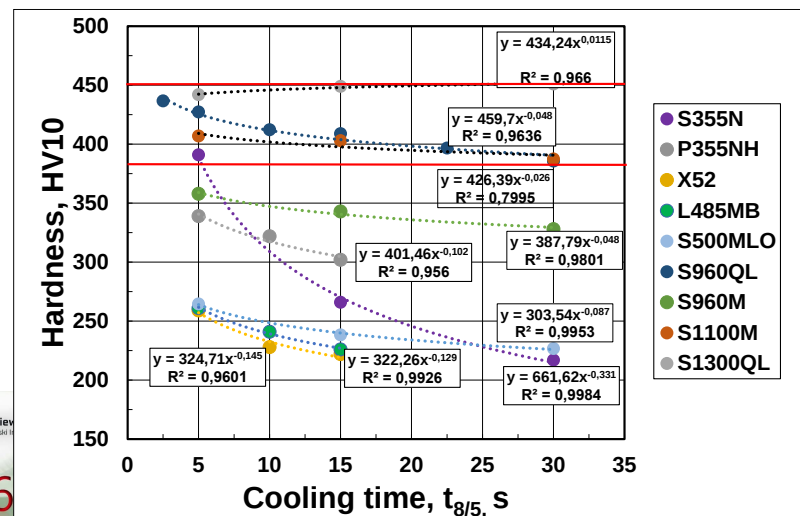
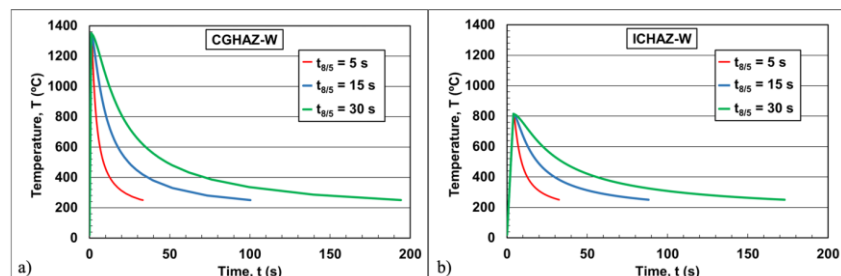




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HAZ characterization by physical simulation

- Gleeble 3500 thermomechanical physical simulator
- Instrumented Charpy V-notch impact testing



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 HUNGARIAN ASSOCIATION OF WELDING TECHNOLOGY AND MATERIAL TESTING

Publications:

Kovács, J. ; Gáspár, M. ; Lukács, J. ; Tervo, H. ; Kaijalainen, A.:

Comparative study about the results of HAZ physical simulations on different high-strength steel grades WELDING IN THE WORLD , 16 p. (2024) <https://doi.org/10.1007/s40194-024-01714-8>

Gáspár, M.; Sisodia, R.P.S.; Dobosy, Á. Physical Simulation-Based Characterization of HAZ Properties in Steels. Part 2. Dual-Phase Steels, STRENGTH OF MATERIALS 51 : 5 pp. 805-815. (2019)

<https://doi.org/10.1007/s11223-019-00128-y>

Gáspár, M.: Effect of Welding Heat Input on Simulated HAZ Areas in S960QL High Strength Steel, METALS 9 : 11 Paper: 1226 (2019) <https://doi.org/10.3390/met9111226>

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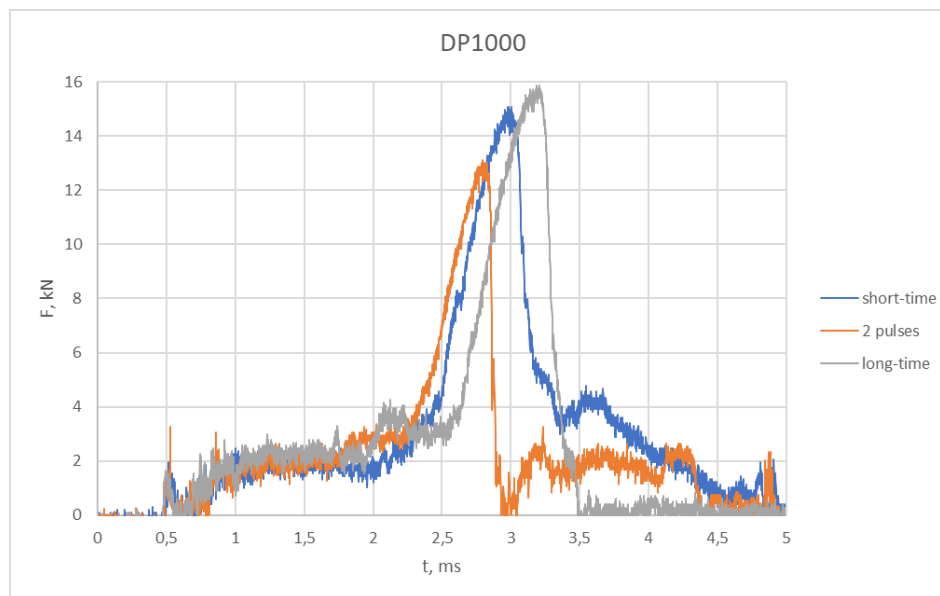




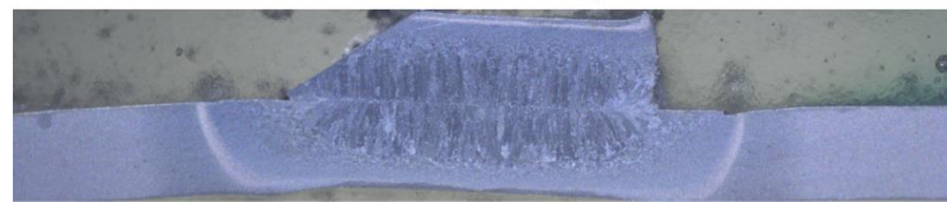
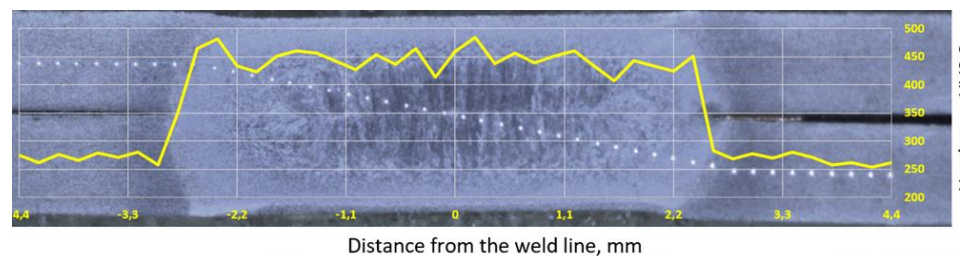
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Resistance spot welding

- base materials: DP steels,
- technologies: short-time welding, 2-pulses welding, long-time welding.
- dynamic tests and failure analyses.

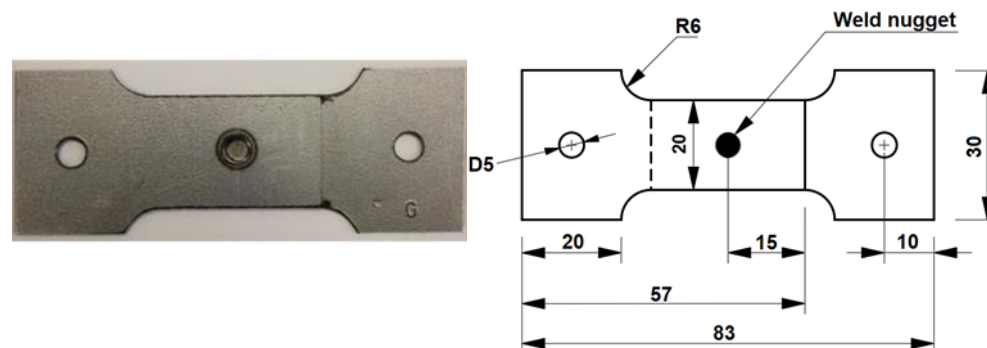


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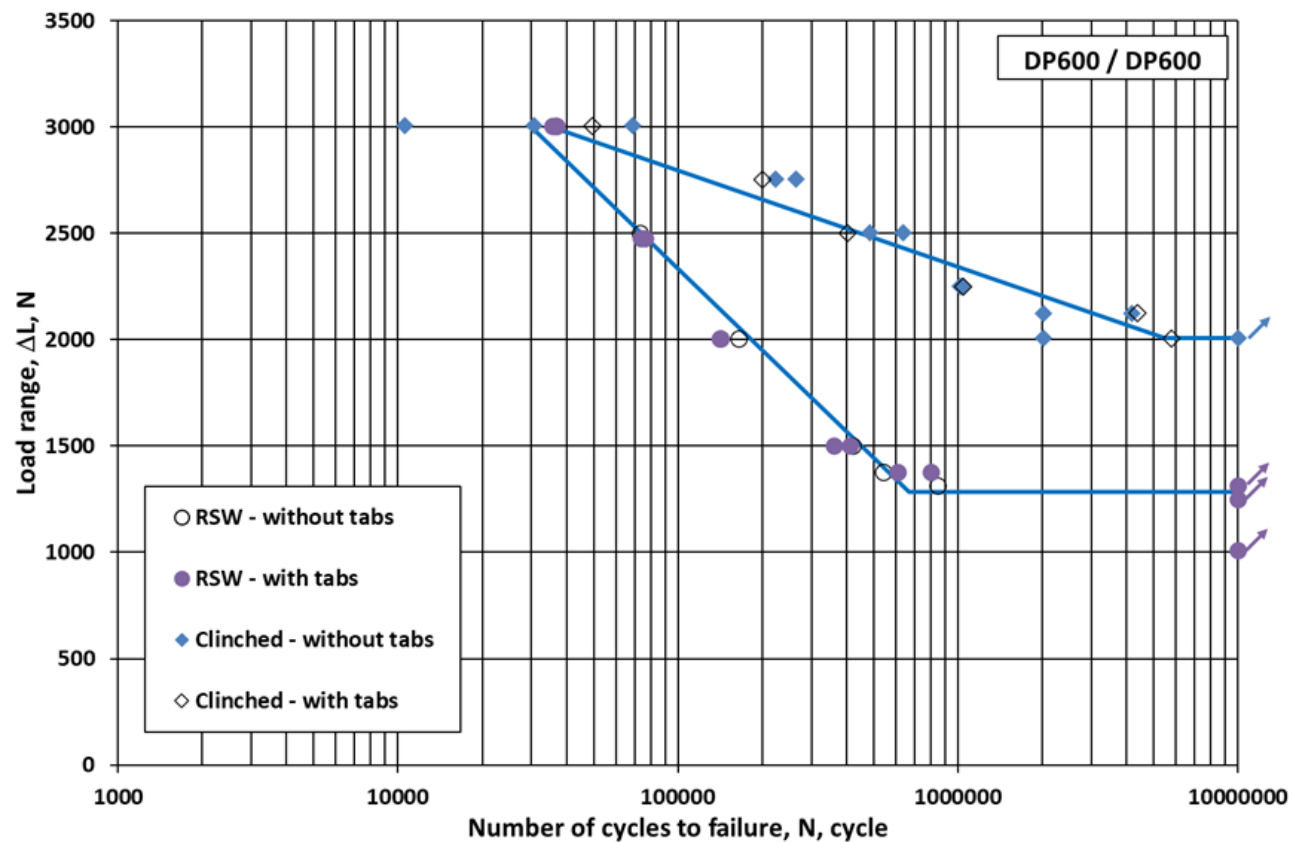
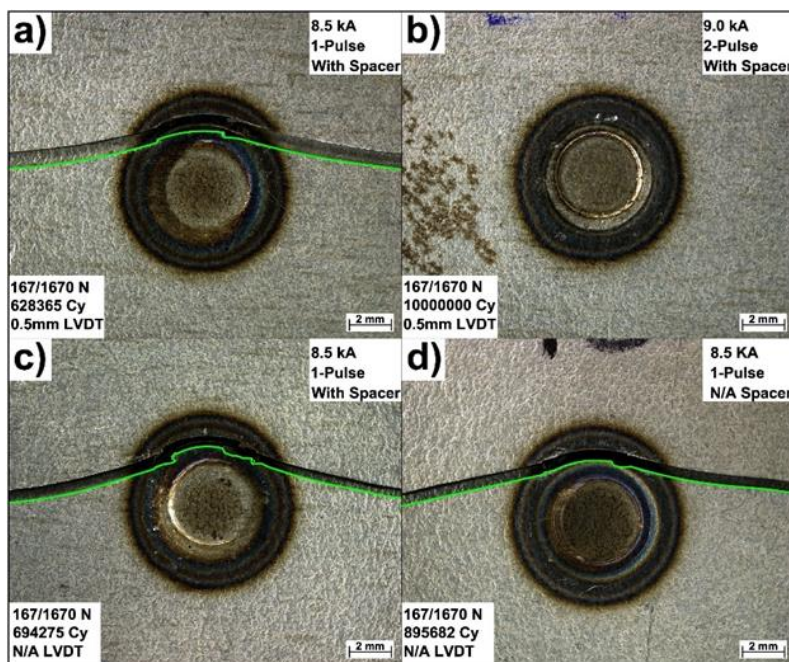
Hardness, HV0,2

Distance from the weld line, mm



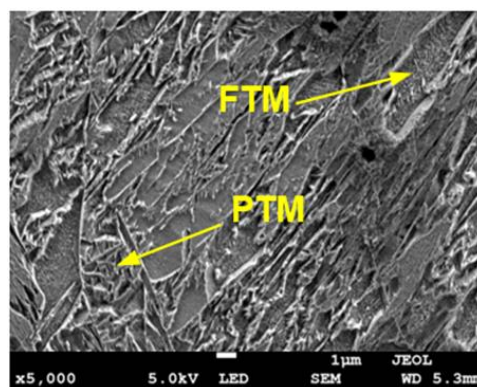
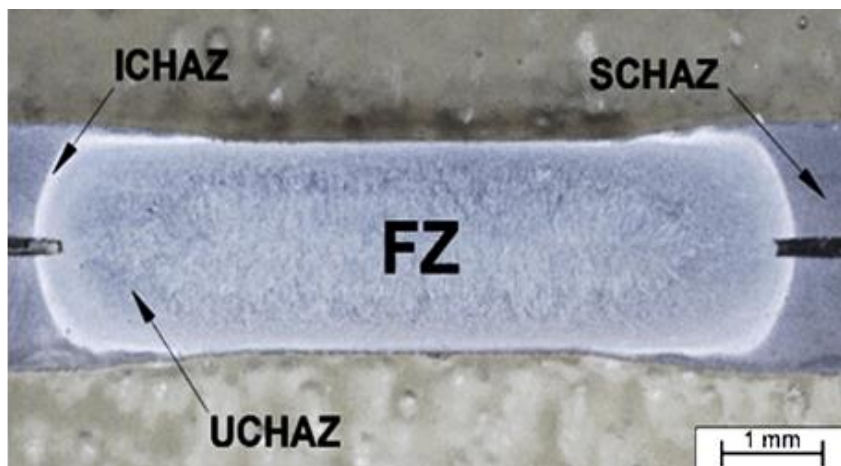
Resistance spot welding

- base materials: DP and MS steels,
- technologies: long-time welding compared with clinching,
- high cycle fatigue (HCF) test,
- failure analyses.

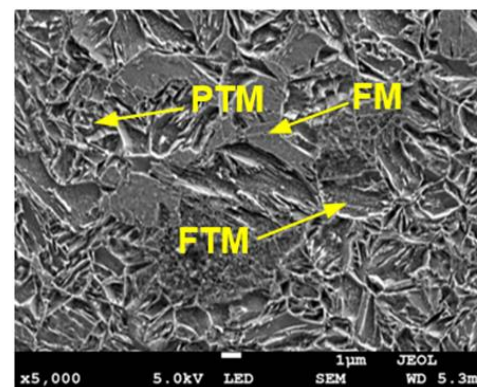


Resistance spot welding

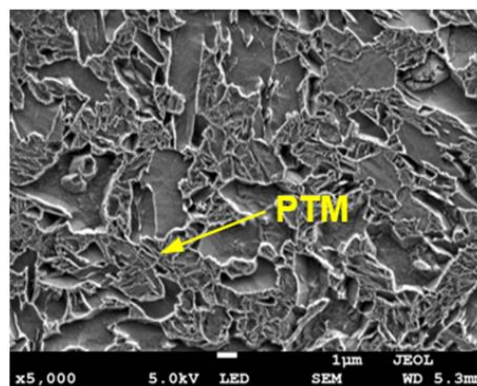
- base materials: MS1400 steel,
- technologies: 2-pulses welding, long-time welding.
- microstructural analyses,



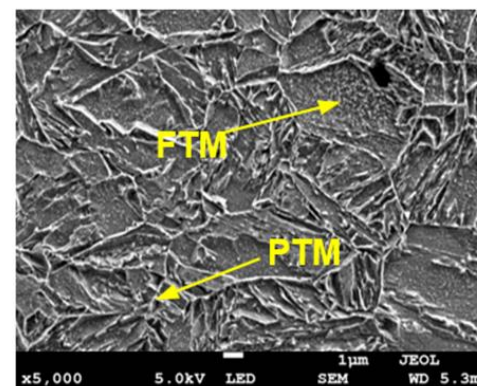
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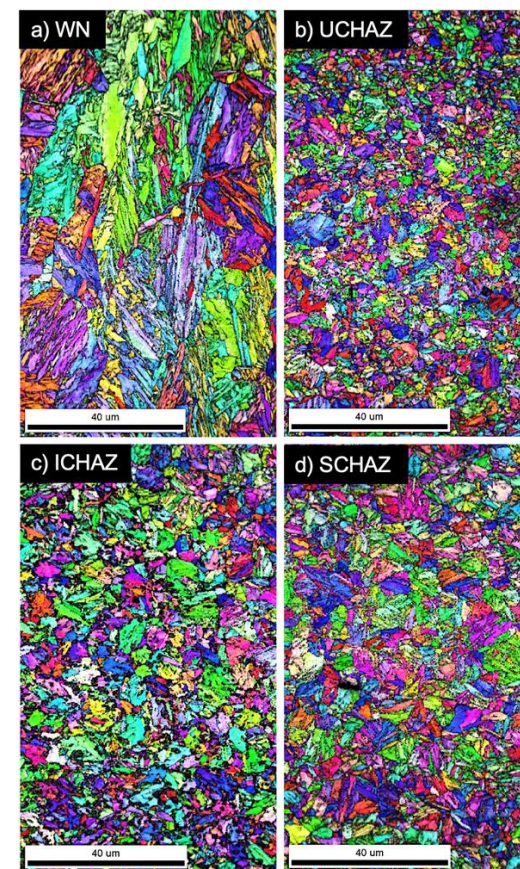
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c.)



d.)

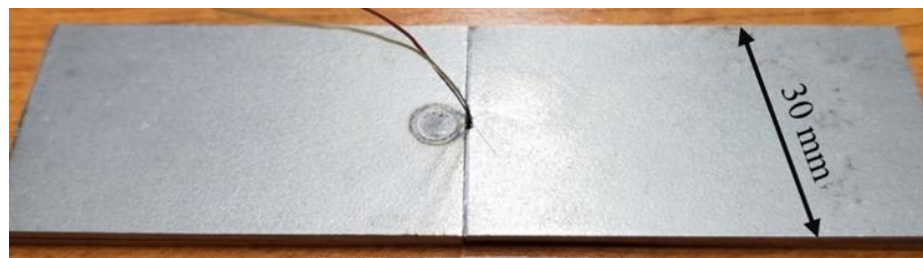
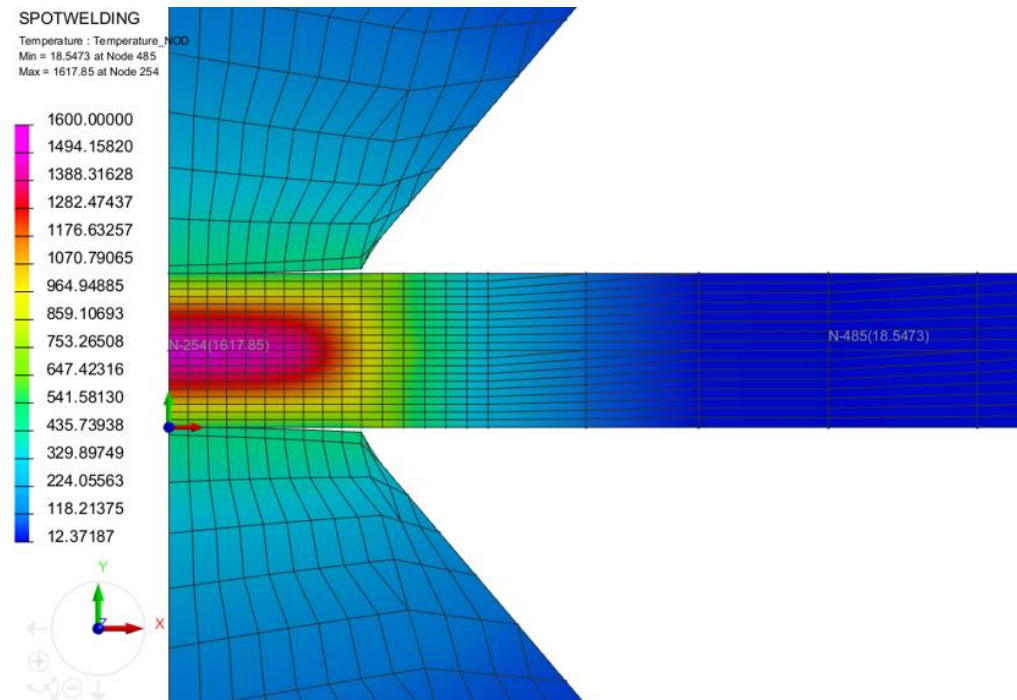
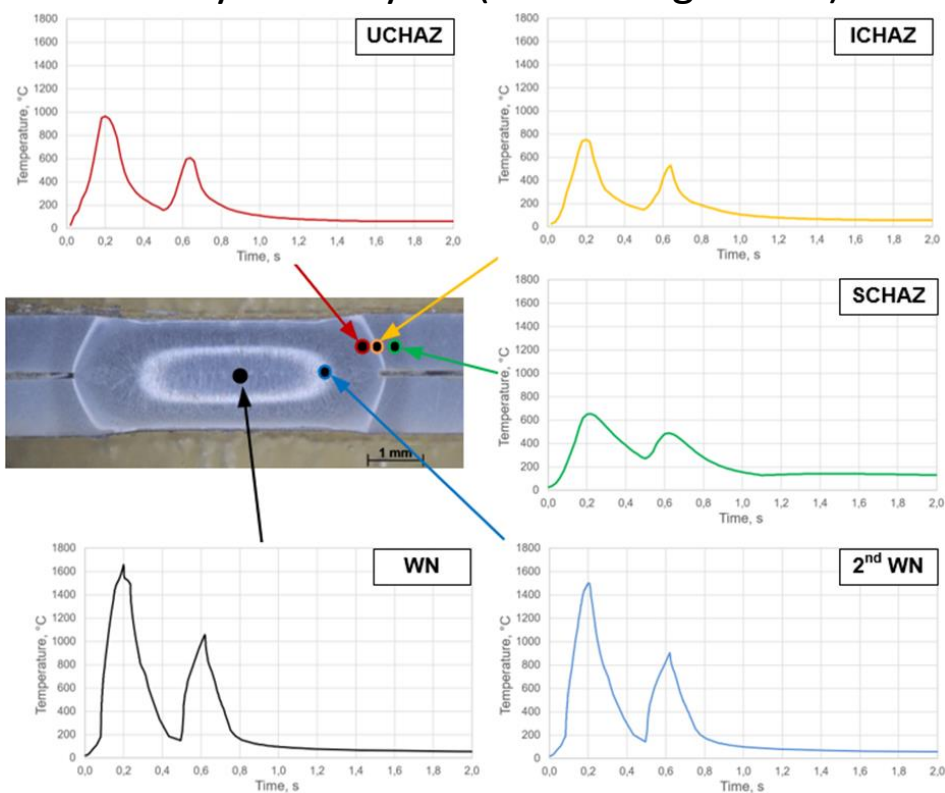




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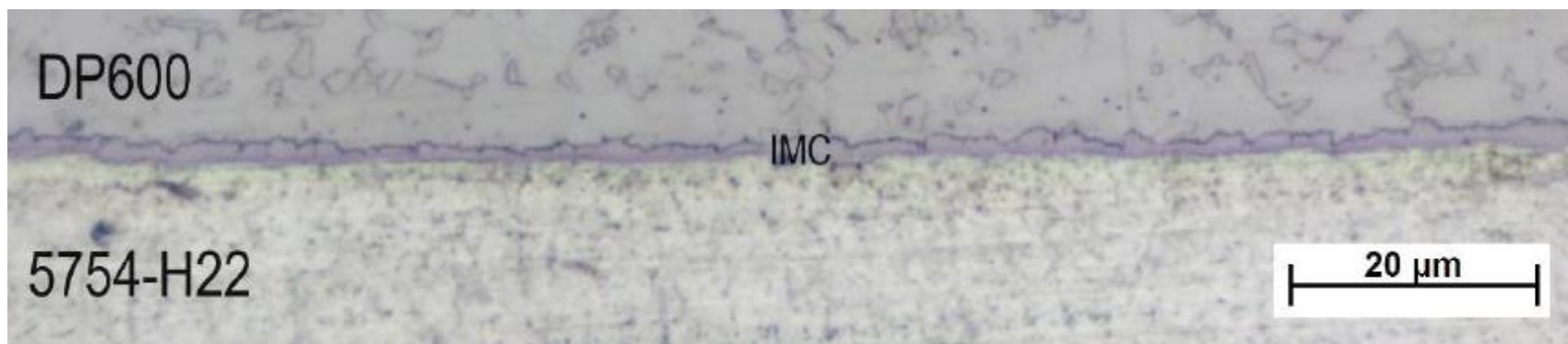
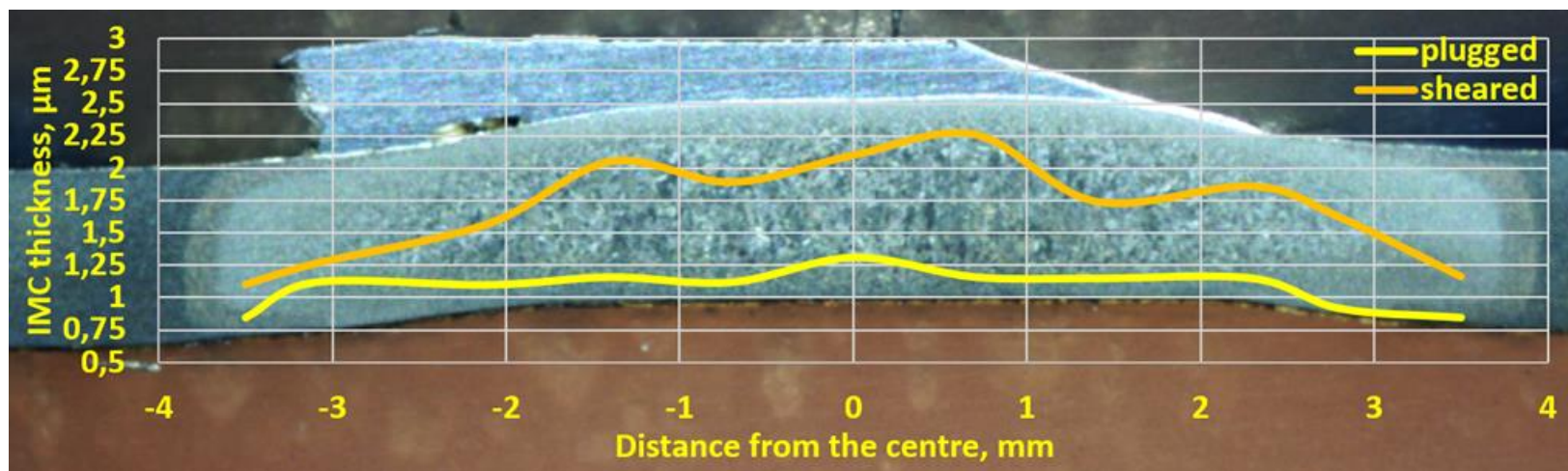
Resistance spot welding

- base materials: DP and MS steels,
- technologies: short-time welding, 2-pulses welding, long-time welding,
- thermal cycle analyses (measuring + FEM).



Resistance spot hybrid welding

- base materials: aluminium + DP steel,
- parameter optimization,
- IMC layer analyses.

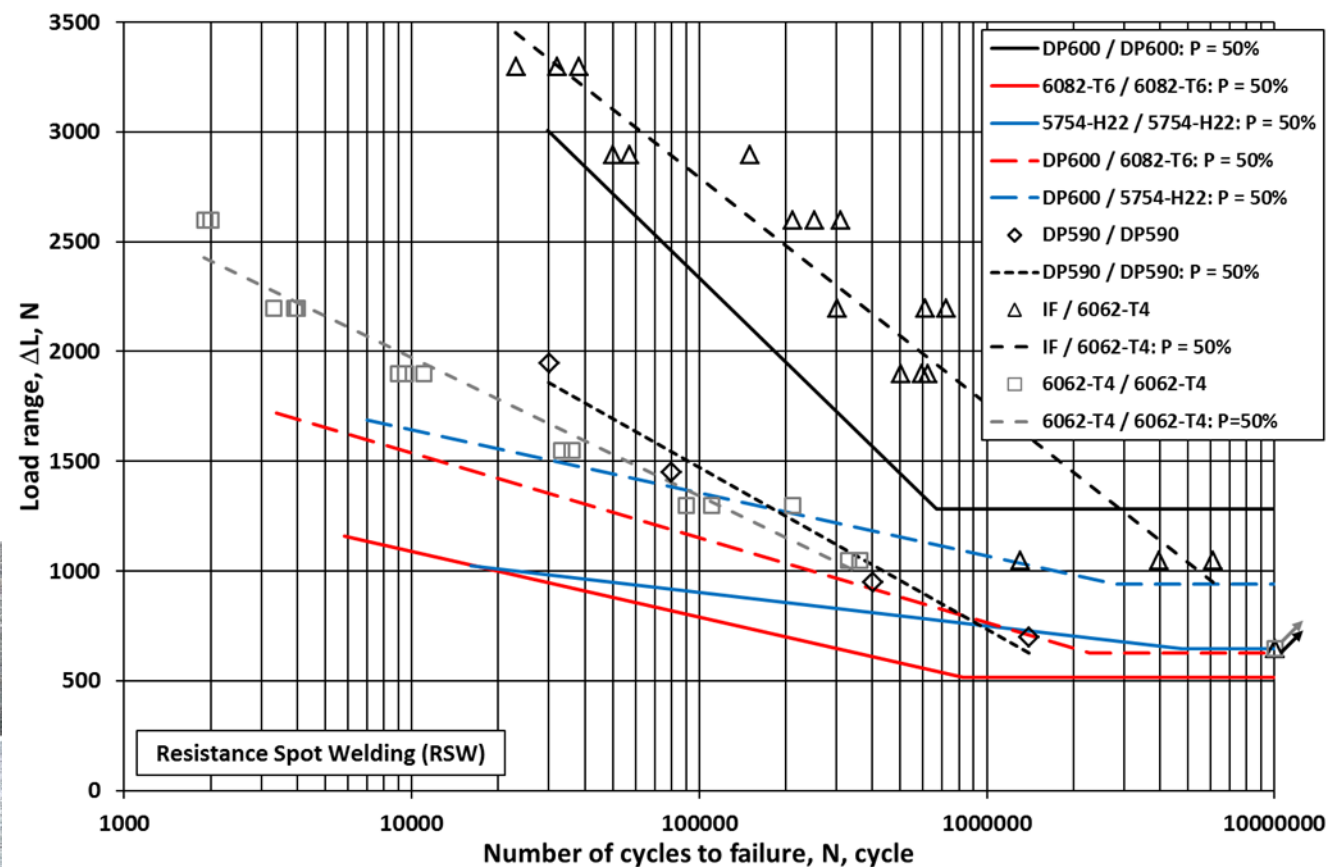




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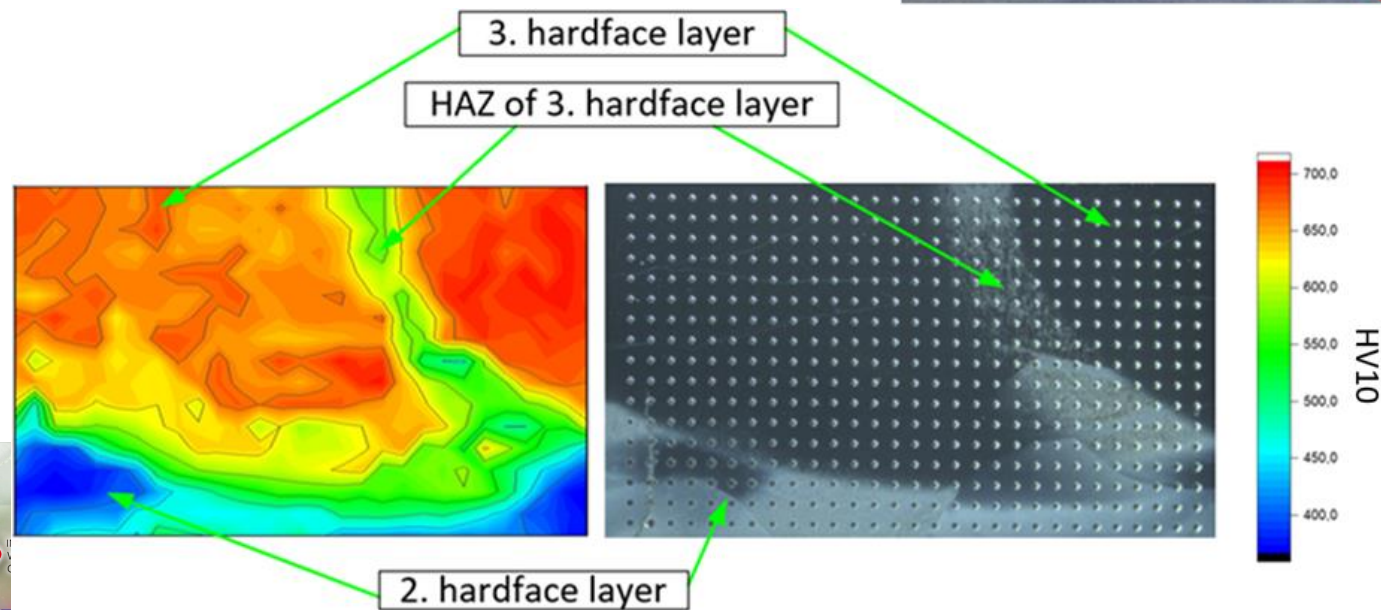
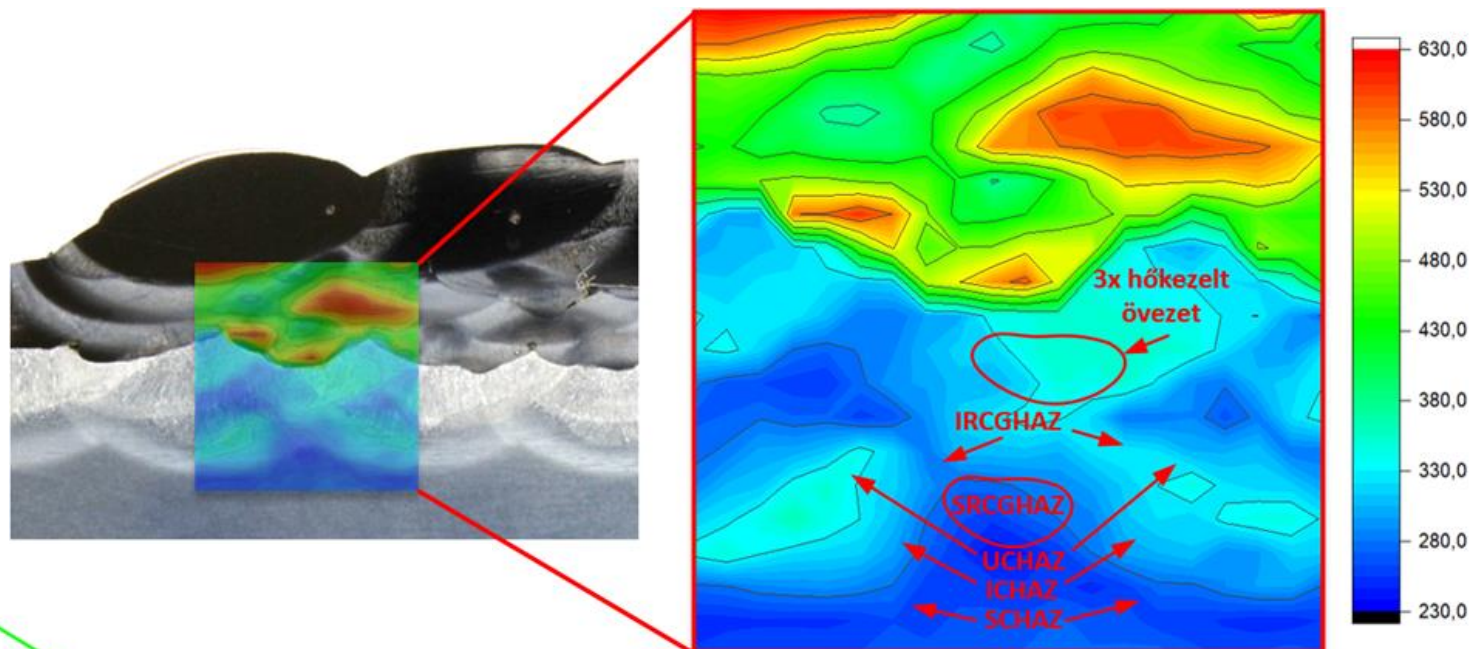
Resistance spot hybrid welding

- base materials: aluminium + DP steel,
- high-cycle fatigue tests and comparison with clinching,
- failure analyses.



Hardfacing

- base materials: S690QL, S960QL and S1100QL,
- analyses of heat-affected zone,
- hardness maps,
- optimization of technology (heat input, pre-heating).





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HUNGARIAN ASSOCIATION OF WELDING TECHNOLOGY AND MATERIAL TESTING

Publications:

Meilinger, Ákos; Cserépi, Mariann Fodorné; Lukács, János: Behaviour of aluminium/steel hybrid RSW joints under high cycle fatigue loading WELDING IN THE WORLD 68 : 2 pp. 427-440. , 14 p. (2024)

<https://doi.org/10.1007/s40194-023-01663-8>

Sahm, Alden Anis Mohammad Abd al al; Mariann, Cserépi; Marcell, Gáspár; Meilinger, Ákos: Optimizing Sample Preparation for Destructive Testing in Resistance Spot Welding JOURNAL OF PHYSICS-CONFERENCE SERIES 2848 Paper: 012005 , 15 p. (2024) <https://doi.org/10.1088/1742-6596/2848/1/012005>

Meilinger, Ákos; Prém, László; Abd Al Al, Sahm Alden; Gáspár, Marcell: Comparion of RSW technologies on DP steels with modified instrumented Charpy impact test, WELDING IN THE WORLD 67 : 8 pp. 1911-1922., 12 p. (2023) <https://doi.org/10.1007/s40194-023-01526-2>

Meilinger, Ákos; Lukács, János: Characteristics of fatigue cracks propagating in different directions of FSW joints made of 5754-H22 and 6082-T6 alloys, MATERIALS SCIENCE FORUM 794-796 pp. 371-376., 6 p. (2014) <https://doi.org/10.4028/www.scientific.net/MSF.794-796.371>





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janos.lukacs@uni-miskolc.hu

High Cycle Fatigue (HCF) investigations

Aims

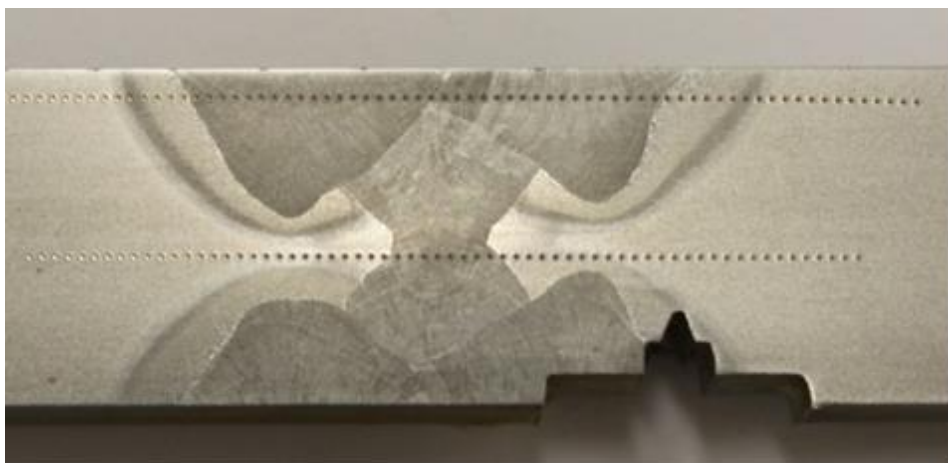
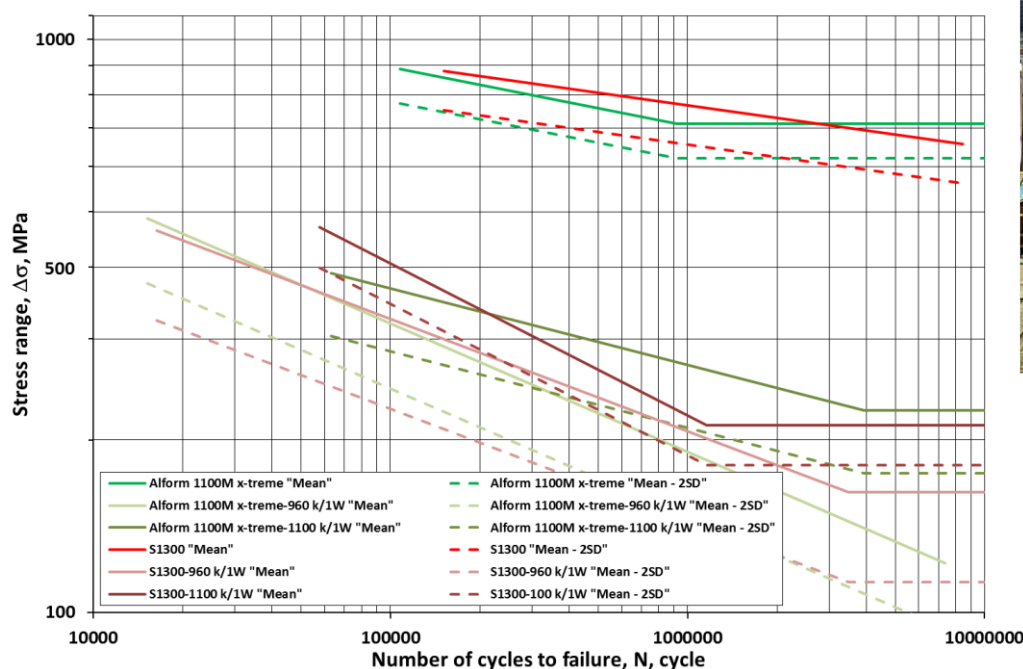
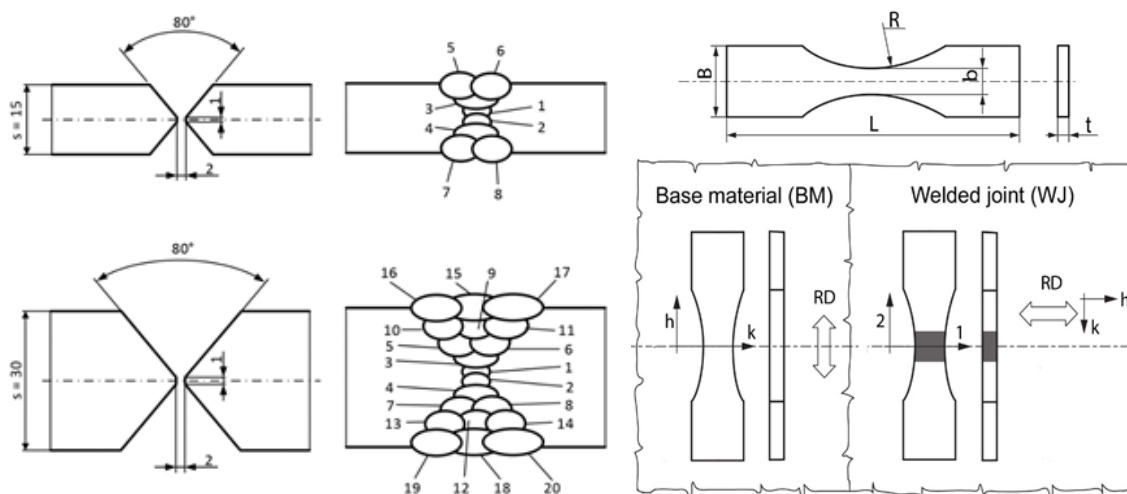
- ✓ developing welding technologies
- ✓ determination of high cycle fatigue design curves

Materials and welding

- ✓ 700Q, 960Q, 960M, 1100M, 1300Q
- ✓ GMAW joints: UM, M, OM

Results

- ✓ applicable welding technologies
- ✓ HCF design curves



Fatigue Crack Growth (FCG) tests

Aims

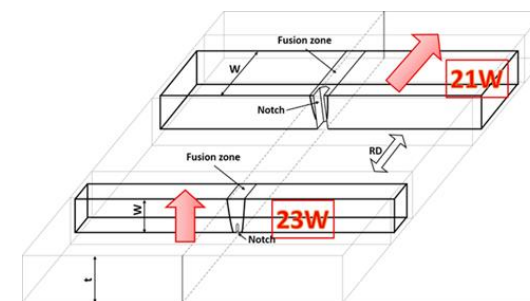
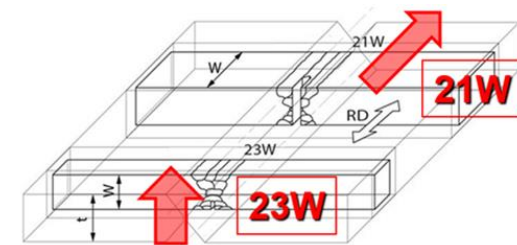
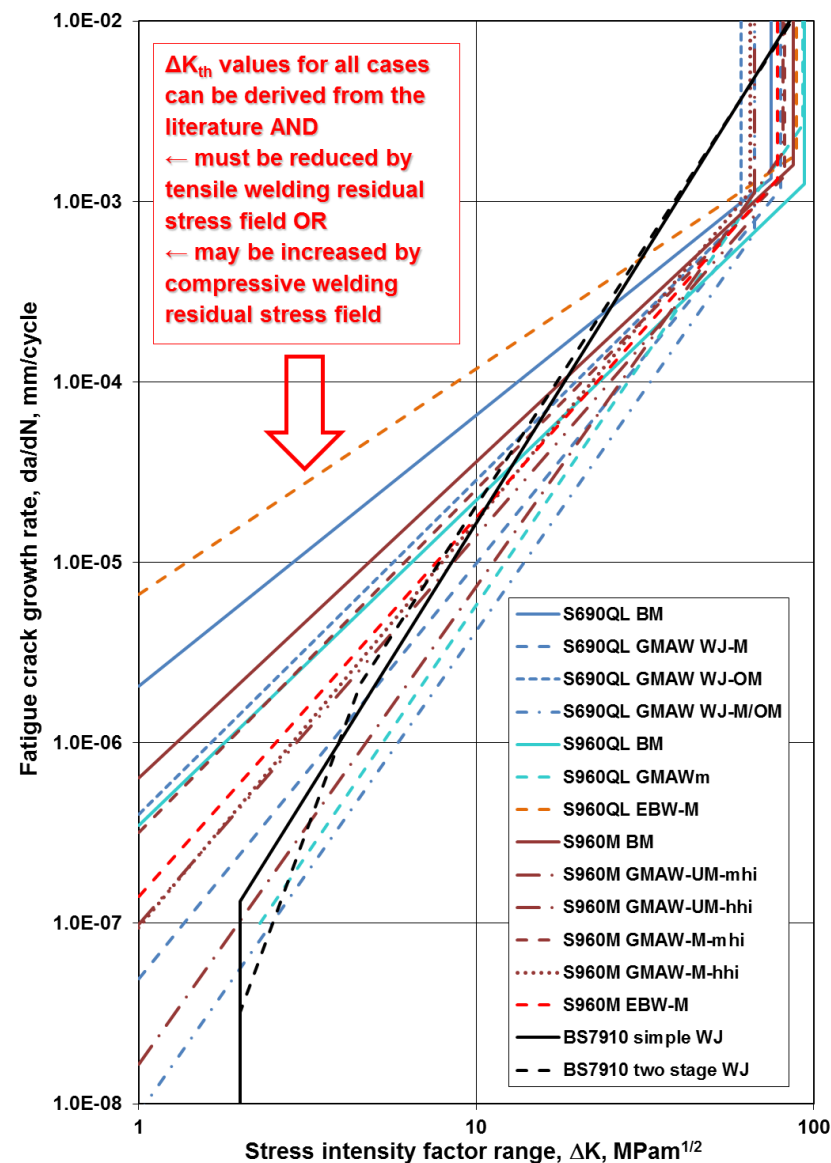
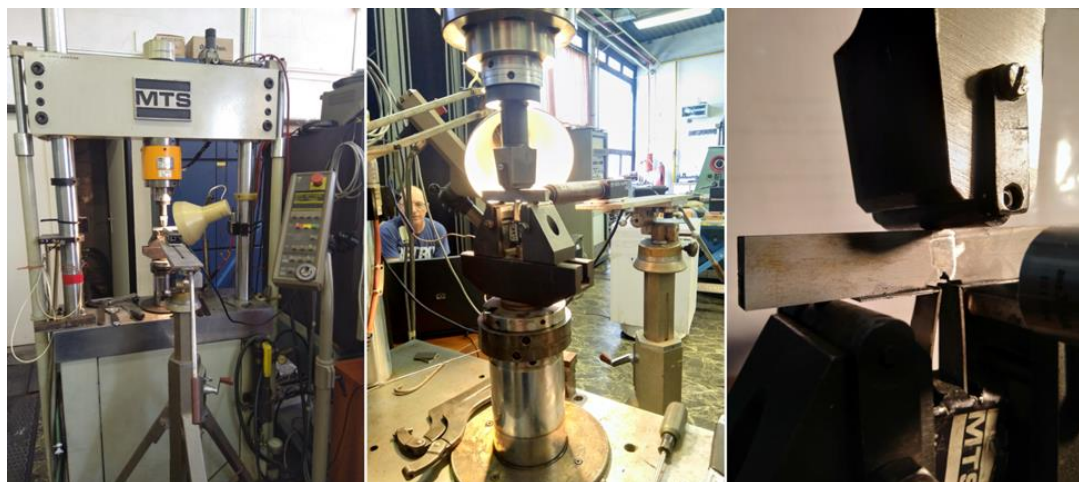
- ✓ determination of fatigue crack growth design curves
- ✓ comparing welding technologies

Materials and welding

- ✓ 960Q, 960M
- ✓ GMAW joints: UM, M, OM, M/OM vs. EBW: M

Results

- ✓ FCG design curves
- ✓ ranking welding technologies



Fatigue Crack Growth (FCG) tests

Aims

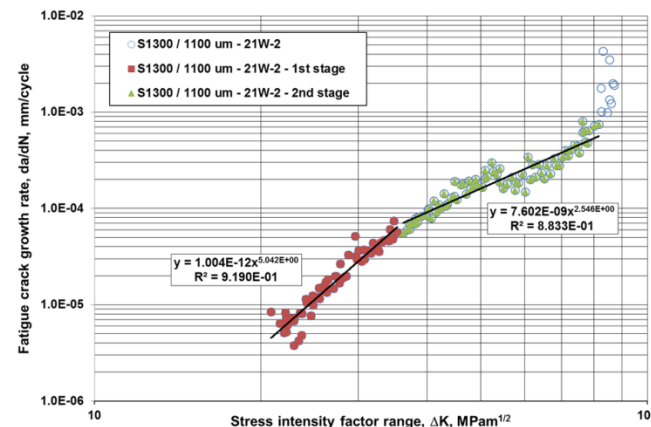
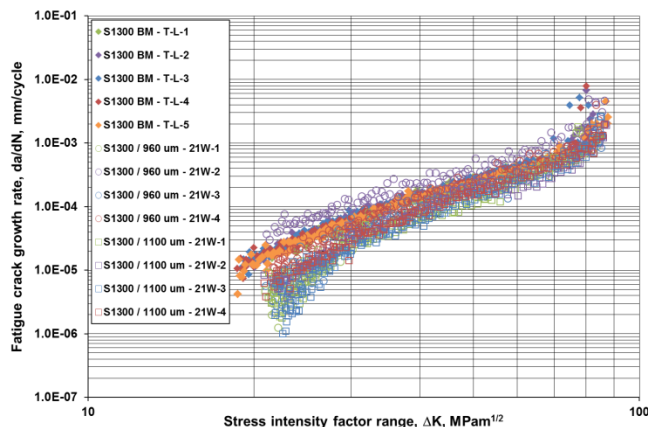
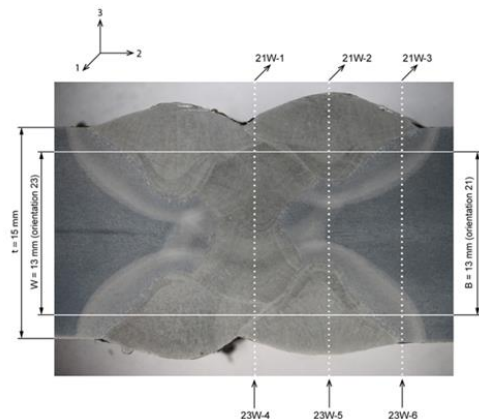
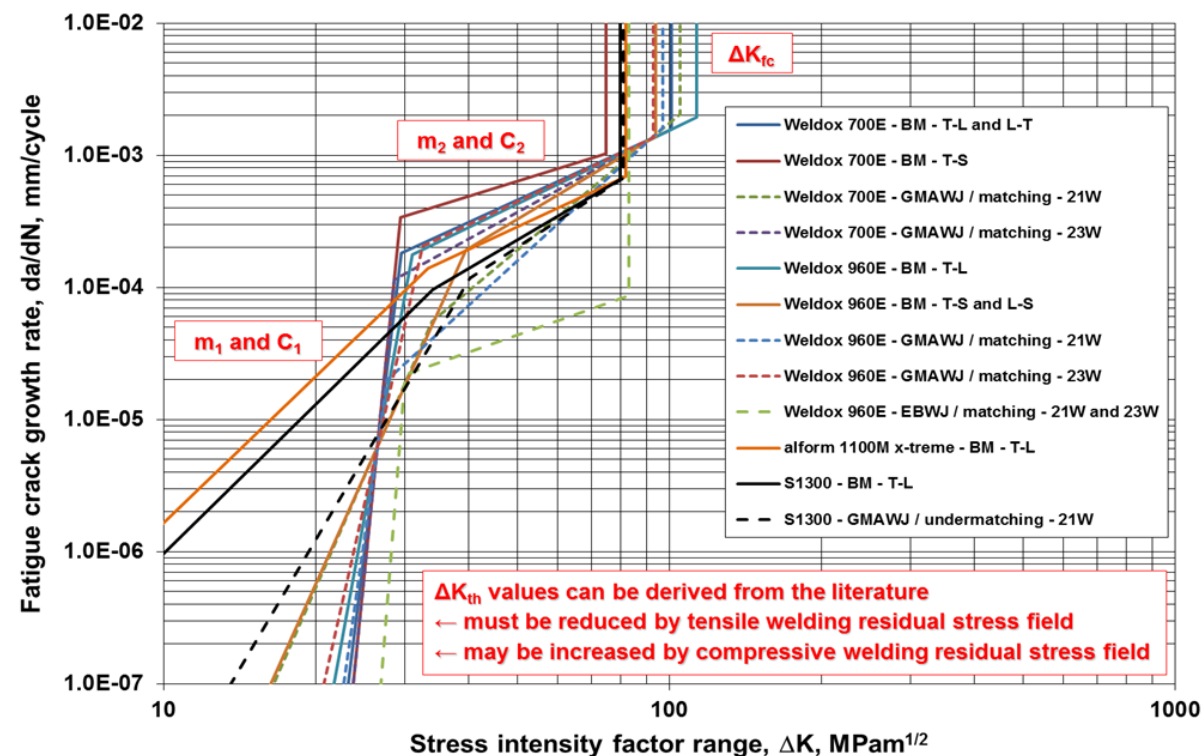
- ✓ determination of fatigue crack growth design curves based on two stage relationship
- ✓ comparing welding technologies

Materials and welding

- ✓ 700Q, 960Q, 1100M, 1300Q
- ✓ GMAW joints: UM, M vs. EBW: M

Results

- ✓ FCG design curves based on two-stage relationship
- ✓ ranking welding technologies



Full-scale tests on replaced natural gas pipeline sections containing girth welds

Aims

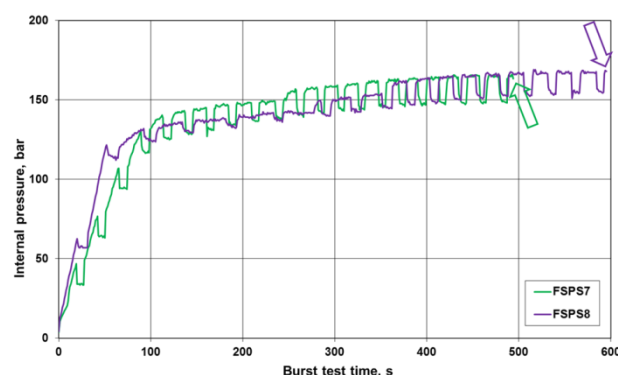
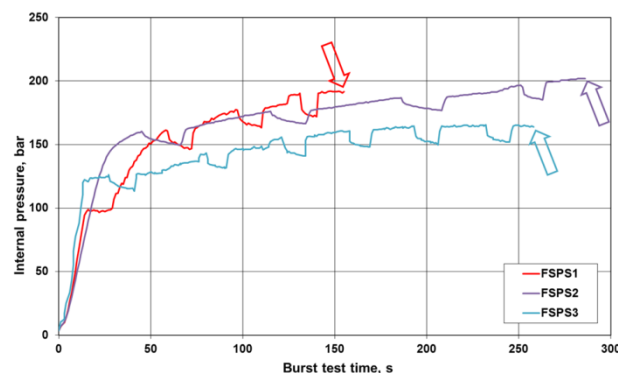
- ✓ determination of load-bearing capacity of pipeline girth welds after long-time operation
- ✓ quantifying the safe operation of girth welds

Materials and welding

- ✓ X52, X60, X65 (API 5L)
- ✓ MMAW joints: M

Results

- ✓ fatigue and burst test on full-scale pipeline sections
- ✓ determined and calculated safety factor values



Full-scale tests on natural gas pipeline sections containing girth welds under complex loading condition

Aims

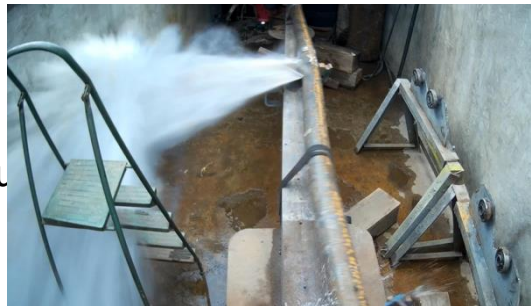
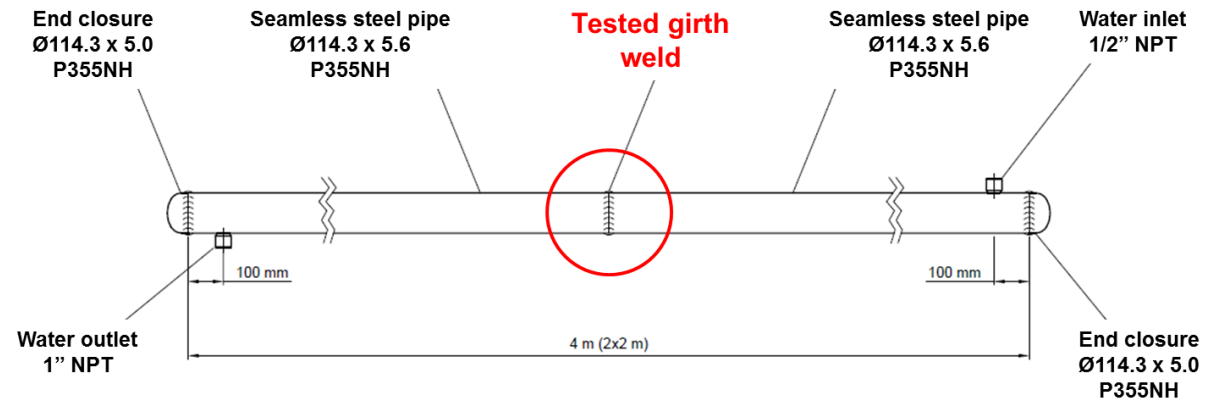
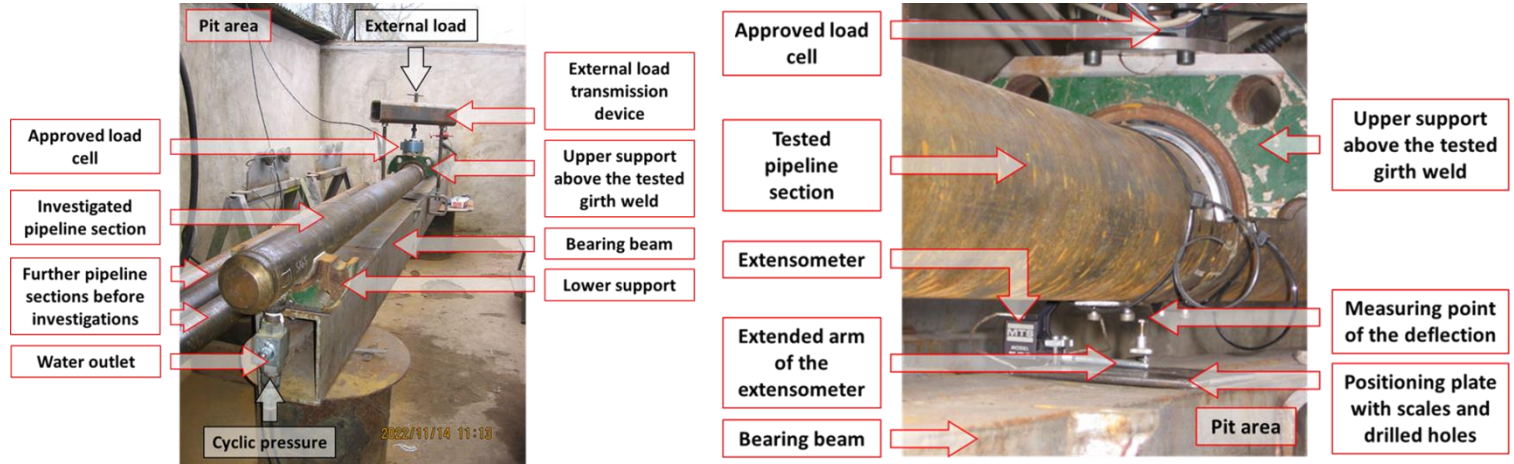
- ✓ determination of load-bearing capacity of pipeline girth welds under complex loading condition
- ✓ quantifying the safe operation of girth welds

Materials and welding

- ✓ X52 (API 5L)
- ✓ MMAW joints: M

Results

- ✓ developed testing system: cyclic internal pressure and static external bending
- ✓ fatigue and burst test on full-scale pipeline sections
- ✓ determined and calculated safety factor value





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Publications:

Lukács, J.: Fatigue crack propagation limit curves for high strength steels based on two-stage relationship, ENGINEERING FAILURE ANALYSIS 103 pp. 431-442. (2019), <https://doi.org/10.1016/j.engfailanal.2019.05.012>

Lukács, J.; Dobosy, Á.: Matching effect on fatigue crack growth behaviour of high-strength steels GMA welded joints, WELDING IN THE WORLD 63 : 5 pp. 1315-1327. (2019) <https://doi.org/10.1007/s40194-019-00768-3>

Sisodia, R. P. S. ; Gáspár, M. ; Lukács, J.: Comparison of fatigue crack growth design curves on GMAW and EBW joints of high strength steels WELDING IN THE WORLD , 19 p. (2024) <https://doi.org/10.1007/s40194-024-01787-5>

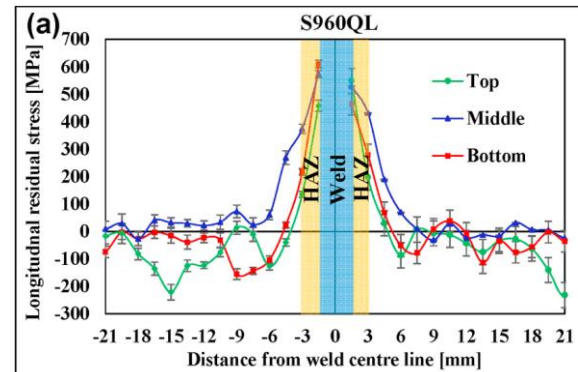
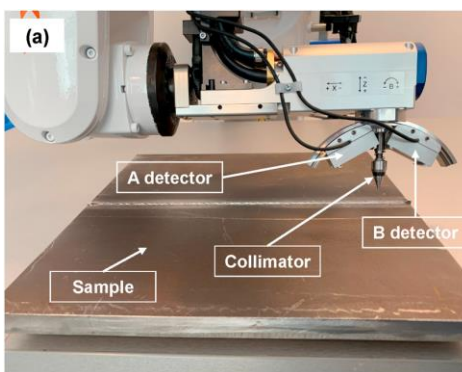
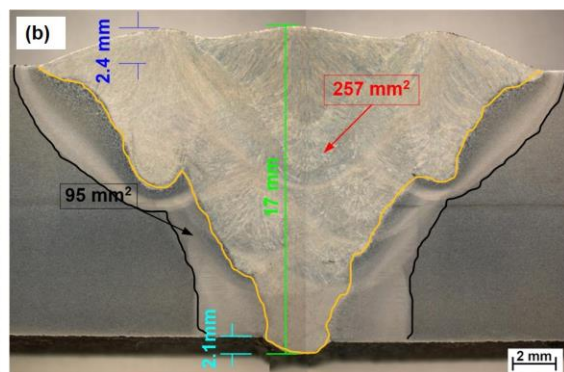
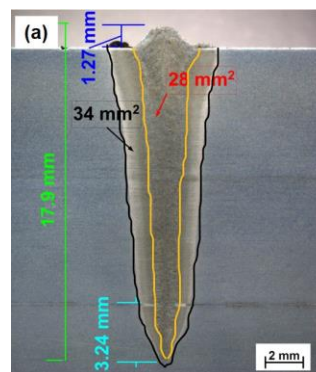
Lukács, J.; Meilinger, Á; Pósalaky, D.: High cycle fatigue and fatigue crack propagation design curves for 5754-H22 and 6082-T6 aluminium alloys and their friction stir welded joints, WELDING IN THE WORLD 62 : 4 pp. 737-749. (2018)
<https://doi.org/10.1007/s40194-018-0599-1>

Dakhel, A. Y. ; Gáspár, M. ; Koncsik, Zs. ; Lukács, J.: Fatigue and burst tests of full-scale girth welded pipeline sections for safe operations WELDING IN THE WORLD 67 : 5 pp. 1193-1208. , 16 p. (2023)
<https://doi.org/10.1007/s40194-023-01501-x>



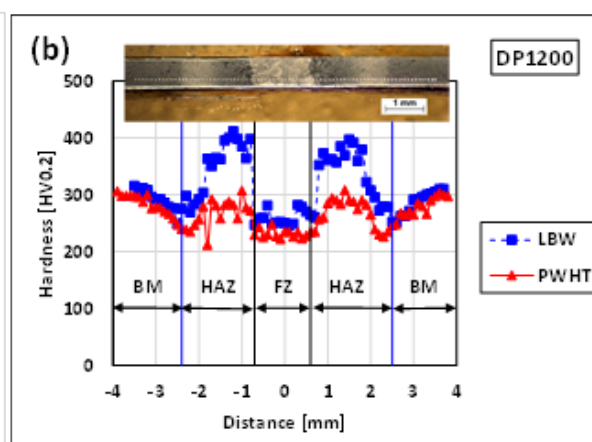
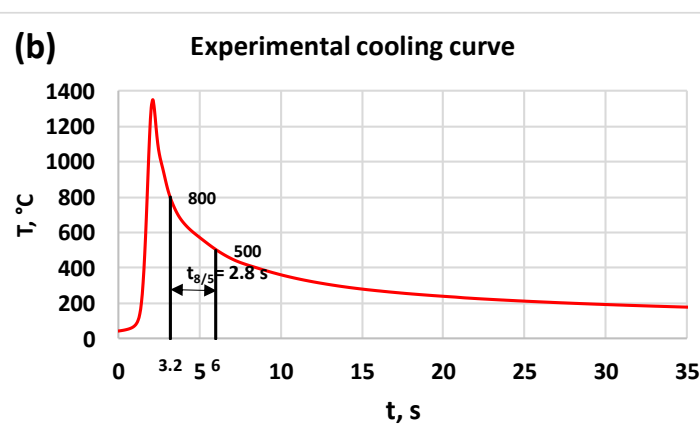
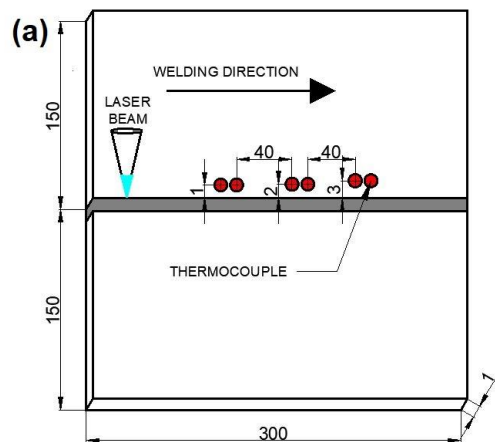
High energy beam welding processes

- Laser beam welding of DP800/1000 and MS1200/MS1400
- Electron beam welding of S960/S1100



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- Initial collaboration began with the meeting of Dr. Marek St. Weglowski (Łukasiewicz – Upper Silesian Institute of Technology, Gliwice, Poland) and Dr. Raghawendra Sisodia (University of Miskolc, Hungary) at the 14th International Conference on Electron Beam Technologies, EBT 2022, held from 26th June - 1st July 2022, Varna, Bulgaria.
- Currently, collaboration process between **the Univeristy of Miskolc, Miskolc, Hungary and the Łukasiewicz – Upper Silesian Institute of Technology, Gliwice, Poland** is underway for a bilateral mobility program (for student and staff exchange) called “**Pannónia Program**”, launched by the **Hungarian Government** in 2024.

Published Articles:

- Sisodia Raghawendra P.S., Gigli Lara, Plaisier Jasper, Mertinger Valéria, Weglowski Marek St., Sliwinski Piotr, “**Synchrotron diffraction residual stresses studies of electron beam welded high strength structural steels**”, *JOURNAL OF MATERIALS RESEARCH AND TECHNOLOGY* 30: pp. 6291-6300., 2024.
<https://doi.org/10.1016/j.jmrt.2024.04.240>. Q1, IF= 6.2.
- Raghawendra Sisodia, Marek Weglowski, Piotr Sliwinski, “**In situ localised post-weld heat treatment with electron beam welding of S690QL steel**”, *JOURNAL OF ADVANCED JOINING PROCESSES*, 2023,
<https://doi.org/10.1016/j.jajp.2023.100182>. Q1, IF= 3.8.





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BOOK Publication with “ELSEVIER Inc, USA” (Under compilation), final publication expected in 2025:

- Raghawendra Sisodia, Zsuzsanna Koncsik, Marek Węglowski, Adam Grajcar, Aleksander Lisiecki, **“WELDING AND JOINING OF ADVANCED HIGH-STRENGTH STEELS AND NON-FERROUS ALLOYS: PROCESSES, MICROSTRUCTURE, AND MECHANICAL PROPERTIES”**.

Journal Under Review (in renowned Journal):

- Raghawendra Sisodia, Piotr Sliwinski, Marek Weglowski, **“Exploring weld thermal cycles in electron beam welding of ultra-high strength steels”**.
- Raghawendra P. S. Sisodia, Piotr Sliwinski, Koncz-Horváth Dániel, Marek St. Weglowski, **“Influence of PWHT on S960QL high strength structural steel electron beam welded joint”**.

Future Publications:

- Various innovative and high-quality research publications are in progress in collaboration.

Future Research Collaborations Plans:

- Welding technology applications like in the field of high energy beam welding processes (Electron beam welding, Laser beam welding) etc.
- Starting Research Grant (by Hungary Govt.) submitted- Some test planned at **Łukasiewicz – Upper Silesian Institute of Technology**.
- Hydrogen transport specialised pipeline steel welding with specialised techniques and other related tests.





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Summary of recent research topics

- ✓ HAZ characterization of structural steels by physical simulation
- ✓ Weldability of duplex stainless steel
- ✓ Resistance Spot Welding (RSW): high strength steels, steel+Al hybrid joining
- ✓ Laser Beam Welding of high strength steels
- ✓ Electron Beam Welding of high strength steels
- ✓ Ultrasonic welding of metals and polymers
- ✓ HCF, FCG of high strength steel welded joints
- ✓ Full-scale tests on steel pipeline sections, effect of hydrogen media
- ✓ Health and safety:
 - Welding fumes
 - UV radiation of arc welding





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Thank you for your attention!



„Polak, Węgier, dwa bratanki, i do szabli, i do szklanki.”

Dr. habil. Marcell Gáspár
 associate professor

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