



International Institute of Welding
Join to the Future

Doc. IV-1598-2024

Annual Assembly Dodecanisa, Rhodes, Greece 2024

Venue: Rodos Palace Hotel, Trianton Avenue, Ixia 85100

Agenda

C-IV: Power Beam Processes

8-11 July 2024

Room: Listed by day of meeting

Chair: Dr. Patrick Hochanadel (USA)

Monday 8 July 2024, 0900-1300 - Nafsika B

1. Opening of the Meeting
2. Request Meeting Secretary to write the Minutes of Meeting
3. Attendees and Apologies, Identification of C-IV delegates
4. Approval of the minutes from the last annual assembly in Singapore (Doc. IV-1588-2023)
5. Adoption and Agreement of Agenda (Doc. IV-1598-2024)
6. Discussion of Joint Intermediate Meeting in Cambridge, UK
7. Presentation of documents

0920 Session 1: C-IV Papers (20 minutes per paper including questions)

[01] 0905: Electron Beam Welding of 2205 Duplex Stainless Steel for Safety Critical Components
D. Holiver, B. Holmes, C. Punshon, S. Smart, and E. Broughton (United Kingdom)
IV-1609-2024

[02] 0925: Life Cycle Assessment in Additive Manufacturing of Copper Alloys – Comparison between Laser and Electron Beam
J. Raute, A. Beret, M. Biegler, and M. Rethmeier (Germany)
IV-1610-2024

[03] 0945: Electron Beam Welding of Motor Stator Wire for Mass Production Environments
A. Ofarrell, D. Chantzis, M. Higgins, W. Dunn, and C. Guest (United Kingdom)
IV-1612-2024

[04] 1005: Electron Beam Welding of Battery Packs
C. Ribton, V. Jefimovs, and D. Holiver (United Kingdom)
IV-1611-2024

[05] 1025: Factors Affecting Quality and Properties of Local Vacuum Power beam Welds in Energy Application
C. Punshon (United Kingdom)
IV-1613-2024

1045-1115: Coffee break

1115 Session 2: C-IV Papers (20 minutes per paper including questions)

[06] 1120: Laser Beam Welding in Vacuum for Additive Manufactured Parts – Development of a multilayer vacuum insulated hydrogen cryogenic tank
B. Gerhards, P. Stockem, J. Bührung, S. Leuders, F. Eichler, and S. Bremen (Germany)
IV-1615-2024

[07] 1140: Quantifying and Evaluating Efficacy of Window Protection Systems in Laser in Vacuum Welding
M. Nentwich (United Kingdom)
IV-1616-2024

[08] 1200: In-Situ Monitoring and Online Prediction on Keyhole Penetration In Robotic Arm Laser Welding Using Melt Pool Images
H.H.L. Núñez, L.-W. Hsu, K.S.B Ribeiro, W.M. Bessa, and A. Salminen (Finland)
IV-1617-2024

[09] 1220: Impact Of Beam Oscillation and Power Modulation on The Intermixing Behavior of Dissimilar Titanium / Niobium / Nitinol Joints during Micro Electron Beam Welding
M. Wiegand, M. Kahlmeyer, W. Song, and S. Böhm (Germany)
IV-1618-2024

[10] 1240: Prediction of Porosity Formation in High-Power Laser Beam Welding using Physics-Informed Machine Learning Framework
X. Meng, M. Bachmann, K. Pascal, M. Rethmeier (Germany)
IV-1614-2024

Close of Day 1 Activities

Tuesday 9 July 2024, 0855 -1830 @ Delphoi Joint Meeting of C-I, C-IV, and C-XII

Morning Session, 0855-1300 Session 1, Chair: Professor Satoru Asai

0855: Opening of Joint Meeting of C-I, C-IV, and C-XII – Professor Satoru Asai

[11] 0855 3D Printing and Surfacing of Inconel 625 through Automated Wire Arc Additive Manufacturing
C. Goulas, M.J.M. Hermans, A. Rajes, R. Rook, B.E. Satiti, H. Thompson, W. Ya (Netherlands)
Doc. XII-2706-2024/I-1616-2024/IV-1647-2024

[12] 0915: A Heat Source for Milliscale WAAM Technology
S. Shigematsu, H. Komen, M. Tanaka, T. Murata, A. Murata (Japan)
Doc. XII-2696-2024/I-1617-2024/IV-1648-2024

[13] 0935: Mitigation of Ductility Dip Cracking in Invar 36 Alloy during Wire Arc Additive Manufacturing through Enhanced Cooling and *in-situ* Alloying of TiC Particles
C. Goulas, M. Herman, V. Popovich, A. Sood (Netherlands)
Doc. XII- 2687-2024 /I-1618-2024/IV-1649-2024

[14] 0955 Forming Regulation in Additive Manufacturing based on a Novel Model: In-order Stacking of Primitives
S. Chen, J. Xiao, Z. Yan (China)
Doc. XII- 2685-2024 /I-1619-2024/IV-1651-2024

[15]1015: Feasibility Study on Machine Learning Methods for the Prediction of Process Parameters for the WAAM Process using SS-316L Filler Material
A.H. Reise , P.S. Sharath, S. Sheikhi (Germany)
Doc. XII- 2682-2024 /I-1620-2024/IV-1650-2024

Presentation by IIW Staff/Elisabetta Sciacaluga (IIW)

Coffee Break (1045– 1115)

Session 2, Chair: Professor Satoru Asai

[16] 1115: Combination of the Melt Pool Geometry Parameters with the Audio Data for Defect Detection in GMAW and WAAM
D. Havrylov (Canada)
Doc. XII-X 2684-2024 /I-1621-2024/IV-1652-2024

[17] 1135: Influence of Edge Surface Quality on Hybrid Laser Arc Welding of Structural Steel S355J2
M. Petreski, D. Runchev, G. Vrtanoski, A. Krstevska (North Macedonia)
Doc. XII- 2668-2024 /I-1622-2024/IV-1653-2024

[18] 1155: Application of Tailor Welded Blanks to Rudder Frame Using Laser-Arc Hybrid Welding
T. Era, K. Takeda, T. Egawa, K. Kashiwabara, M. Tatsutomi, H. Uchiyama (Japan)
Doc. XII- 2689-2024 /I-1623-2024/IV-1654-2024

[19] 1215: Investigating the Effect of Shielding Gas on Arc Plasma Behaviors and Welded Quality in GMAW-GTAW Hybrid Welding Process on AA5083 Aluminium Alloy
T. Methong, R. Boonrungrsee, B. Chanprasertkul (Thailand)
Doc. XII- 2666-2024 /I-1624-2024/IV-1655-2024

[20] 1235: Effect of Current Waveform in MIG Arc on Weld Bead Formation in Plasma-MIG Hybrid Welding
S. Tashiro, K. Ishida, K. Nomura, D. Wu, A.B. Murphy, T. Yuji, M. Tanaka (Japan)
Doc. XII- 2701-2024 /I-1625-2024/IV-1656-2024

Afternoon Session, 1425-1830 **Session 3, Chair: Dr. Patrick Hochanadel**

1425: Opening of Afternoon Session of C-I, C-IV, and C-XII – Dr. Patrick Hochanadel

[21] 1425: Effect of Welding Speed on Keyhole Behavior and Spatter Formation in Full Penetration Laser Beam Welding using High-Speed Synchrotron X-Ray Imaging
C. Diegel, K. Schrickler, L. Schmidt, M. Seibold, H. Friedmann, P. Hellwig, F. Fröhlich, J.P. Bergmann, F. Nagel, P. Kallage, A. Rack, H. Requardt, and Y. Chen (Germany)
Doc. XII-2711-2024/I-1626-2024/IV-1619-2024

[22] 1445: Development of Wire-based Laser Metal Deposition with Blue Diode Laser for Pure Copper
S. Yoshida, M. Mizutani, K. Takenaka, Y. Sato, M. Tsukamoto (Japan)
Doc. XII-2712-2024/I-1627-2024/IV-1620-2024

[23] 1505: Laser Beam Submerged Arc Hybrid Welding of Thick High-Strength Pipeline Steels
M. Clemens, S. Olschok, and U. Reisinger (Germany)
Doc. XII-2713-2024/I-1628-2024/IV-1621-2024

[24] 1525: Challenges in Modelling Dynamic Heat Sources in High-Power Laser Beam Welding
M. Bachmann, W. Meng, A. Artinov, and M. Rethmeier (Germany)
Doc. XII-2714-2024/I-1629-2024/IV-1622-2024

[25] 1545: Investigation on the Microstructure and Mechanical Properties of Dissimilar Joint of PBF-LB/M/IN718 to AISI 316L by Laser Welding
S. Parchegani, H. Piili, M. Amraei, S. Afkhami, and A. Salminen (Finland)
Doc. XII-2715-2024/I-1630-2024/IV-1608-2024

Coffee Break (1615 – 1645)

Session 4, Chair: Dr. Patrick Hochanadel

[26] 1645: **Open**
Doc. XII-2716-2024/I-1631-2024/IV-1623-2024

[27] 1705: Effect of Local Gas Supply on Keyhole Dynamics in Laser Beam Welding of High-Alloy Steel AISI 304 by means of High-Speed Synchrotron X-Ray Imaging
L. Schmidt, K. Schrickler, C. Diegel, H. Requardt, Y. Chen, A. Rack, and J.P. Bergmann (Germany)
Doc. XII-2717-2024/I-1632-2024/IV-1624-2024

[28] 1725: Laser Welding with Superimposed Beam Oscillation in the Direction of Propagation
M. Pieper (Germany)
Doc. XII-2718-2024/I-1633-2024/IV-1625-2024

[29] 1745: A New Additive Manufacturing Technique by Laser Melting of Sheets Binding Metal Powder
A.F.H. Kaplan, P. Guo, J. Volpp, H. Naesstroem, R. Lupoi, R. Casati, S. Marola, (Sweden)
Doc. XII-2719-2024/I-1634-2024/IV-1626-2024

[30] 1805: The Study on the Prediction Model of Weld Depth during Fiber Laser Deep Penetration Welding based on Primary Absorption of the Front Keyhole Wall
B. Zhu, J. Zou, R. Xiao, T. Huang (China)
Doc. XII-2720-2024/I-1635-2024/IV-1627-2024

1825: Close Out of First Day Joint Meeting of C-I, C-IV, and C-XII – P. Hochanadel

Wednesday 10 July 2024, 0900-1300 @ Nafsika B **Commission IV Meeting (continued from Monday)**

0900: Session 3: C-IV Papers (20 minutes per paper including questions)

0900: Open and Welcome – Patrick Hochanadel

[31] 0905: Advancements in Welding Techniques for Copper Pipes in Heat Pump Systems: A Comparative Analysis
A. Pereira, J.M.S., Dias, A. Horovistiz, N.M. Silva, S. Duraisamy, E. Lemma, B. Mascate, and D. Costa (Portugal)

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[32] 0925: Mechanical Behaviour and Microstructural Evolution during the Laser Welding of Dissimilar Joint Haynes 282 and Inconel 740H by integrating FEM and Phase Field Modelling
M. Arunkumar and G. Phanikumar (India)

IV-1629-2024

[33] 0945: Numerical Investigation of Porosity Mitigation in High-Power Laser Beam Welding with an External Magnetic Field

F. Yang, X. Meng, S.N. Putra, M. Bachmann, and M. Rethmeier(Germany)

IV-1630-2024

[34] 1005: Investigating Numerically and Experimentally the Effect of Martensite Start Temperature on the Residual Stresses and Distortion in Laser Beam Welded T-Joints

K.R. Krishna Murthy, M. Gamerdinger, S. Olschok, and U. Reisgen, (Germany)

IV-1631-2024

[35] 1025: A Novel Fusion Method for Time-Varying Features of Acoustic Emission Signals in Laser Shock Peening Monitoring

R. Qin, Z. Zhang, J. Huang, G. Wen, W. He, and X. Chen, (China)

IV-1632-2024

1045-1115: Coffee break

0900: Session 4: C-IV Papers (20 minutes per paper including questions)

[36] 1115: Effect of concentric intensity distributions on laser beam welding of zinc-coated steels in zero-gap lap joint configuration

M. Seibold, P. Hellwig, K. Schricker, and J.P. Bergmann (Germany)

IV-1633-2024

[37] 1135: Inline Process Monitoring Sensor and Optical Sensor

R. Bola and P. Catarino (Portugal)

IV-1634-2024

[38] 1155: Ta-10W Refractory Alloy Fiber Laser Welding Process Research

X. Du, Q. Wu, and R. Xiao (China)

IV-1635-2024

[39] 1215: Research on Weld Shape and Penetration Laser Welding Stability of Light Alloys Sheet

L. Chen (China)

IV-1636-2024

1235: Continuation of Commission IV Administrative Tasks:

1. Structure of Commission IV: Election of Commission IV Vice-Chair
2. Activities of Commission IV
3. List of Documents (Doc. I-xxxx-24)
4. Joint Workshops/Meetings with Other IIW Units
5. Resolutions by Commission IV from 2024 Meeting
6. Other Business
 - Recommendations for Welding in the World
 - Satisfaction Survey
 - Preparations for Upcoming Annual Assemblies and Intermediate Meetings

7. Adjournment of the 2024 C-IV Meeting

**Thursday 11 July 2024, 0855 -1830 @ Executive B
Joint Meeting of C-I, C-IV, and C-XII**

**Morning Session, 0855-1300
Session 5, Chair: Doug Kautz**

[40] 0855: International Additive Manufacturing Qualification System for Personnel
Ana Beatriz Lopez, Adelaide Almeida,
R. Bola
Doc. XII-2721-2024/I-1600-2024/IV-1637-2024

[41] 0915: Influence of Energy Input and Interpass Temperature on the Mechanical Properties of DED-arc
Manufactured 316L
M. Kohler, I. Schubnell, and K. Dilger (Germany)
Doc. XII-2722-2024/I-1601-2024/IV-1638-2024

[42] 0935: Understanding and Overcoming the Challenges in the Welding of Additively Manufactured
Aluminium Alloys
R. Nunes, K. Faes, W. Verlinde, W. De Waele, M. Lezaack, and A. Simar (Belgium)
Doc.XII-2723-2024/ I-1602-2024/ IV-1639-2024

[43] 0955: Pathway to Qualification for DED-wire Additive Manufacturing
T. Melfi and M. Douglass (USA)
Doc. XII-2724-2024/I-1603-2024/IV-1640-2024

[44] 1015: Wire Arc Additive Manufacturing of High Strength Al-Mg-Si Alloys
A. Pittner, R. Winterkorn, C. Fabry, and M. Rethmeier (Germany)
Doc. XII-2725-2024/I-1604-2024/IV-1641-2024

**1035: Presentation by WiiW
Americo Scotti (IIW)**

Coffee Break (1045– 1115)

Session 6, Chair: Doug Kautz

[45] 1115: Influence of Energy Input and Interpass Temperature on the Mechanical Properties of DED-arc
Manufactured 316L Steel
C. Seow (United Kingdom)
Doc.XII-2726-2024/ I-1605-2024/IV-1642-2024

[46] 1135: Effect of Deposition Strategies on Mechanical Properties and Residual Stresses at The Transition
Zone of Component and Substrate in Hybrid DED-Arc Manufacturing
R. Scharf-Wildenhain, L. Engelking, A. Haelsig, D. Schroepfer, T. Kannengiesser, and J. Hensel (Germany)
Doc. XII-2727-2024/I-1606-2024/IV-1643-2024

[47] 1155: The Effect of Cryogenic Cooling on the Microstructure and Mechanical Properties of Wire and Arc
Additively Manufactured Steels
C. Goulas, M. Ameye, M. Akuh, R. Rook, J.L.G. Argumedo, T. Michelis, W. Ya, I. Gibson, and M. Hermans
(Netherlands)
Doc.XII-2728-2024/ I-1607-2024/ IV-1644-2024

[48] 1215: Experimental and Simulation Approaches to Hydrogen Embrittlement Behaviour of Additively Manufactured Metals and Components

M. Moshtaghi (Finland)

Doc. XII-2729-2024/I-1608-2024/IV-1645-2024

[49] 1235: Investigations on the Additive Manufacturing of Structures Made of Copper-Zinc Alloys using Wire and Arc-Based Welding Processes

M. Schop, T. Ungethum, and H.C. Schmale (Germany)

Doc. XII-2730-2024/ I-1609-2024/IV-1646-2024

1255: Close Out of Joint Meeting of C-I, C-IV, and C-XII – D. Kautz

Close of Day 4 Activities/All Commission Sessions