The Canadian Delegate Report

International Institute of Welding Commission VIII Health, Safety and Environment

David Hisey

This is a summary of the actions of IIW Commission VIII during the July 2022 conference in Tokyo, Japan hybrid meeting. Should additional information be required the specific document may be published on the IIW web site.

INTERNATIONAL INSTITUTE OF WELDING
COMMISSION VIII HEALTH AND SAFETY
ANNUAL ASSEMBLY MEETING 19 - 21 July 2022
Tokyo, Japan – Hybrid Online

Summary

The IIW website is up and functioning and most if not all papers and reports discussed here are available from this report author at drhisey@shaw.ca or the IIW website. The author has attempted to provide a summary or brief overview of each presentation in this document. The national reports are not published and what exists is included in this document only.

Commission VIII has had a complete change of management due to retirements of both the past chair Geoff Melton United Kingdom and vice-chair John Petkovsek USA. Dave Werba of USA has been confirmed as chair and Hong Li of China confirmed as vice-chair during this session.
Due to the remaining Covid restrictions in Japan 8-10 were present in the Tokyo facility, while approximately 18 on average were present online. Meeting times were held based on Tokyo local time.

As a hybrid meeting, the chair Dave Werba ran the meeting from the USA. A large screen was present in the meeting room in Tokyo which displayed the presentations and the speaker in real time. The meeting was successful for those online and I received positive comments from at least one person in the room in Tokyo. The meetings were well attended and received. We have learned to do hybrid meetings well during Covid.

1. **Welcome, Introduction *(David Werba, Chair)***
   Welcome and general information about the meetings
   a. Geoff Melton, Chair C-VIII Retired
   b. John Petkovsek, Vice-Chair C-VIII Retired
   c. Introduction to new members and apologies for absence.
      i. Joe Bailey USA guest
      ii. Therese Dahlstrom ESAB rep – new member
      iii. Joe Bundy USA – new member
      iv. Satoshi - Japan new member

   d. Review and adoption of the agenda (VIII-2343-22)
      i. Agenda adopted as written

   e. Approval of the minutes of the virtual meeting held during the Virtual Intermediate Meeting in 2022 (VIII-2332-22): *Steve Hedrick, Dave Werba* the minutes from the March online meeting were approved as distributed.

2. Nominations/Proposals for the Chair and Vice-chair
   a. Chair to replace Geoff Melton proposed David Werba
      i. Dave Werba proclaimed new Chair
   b. Vice-Chair: election is required; candidate is Hong Li
      i. Hong Li is proclaimed new vice-chair

INTERNATIONAL INSTITUTE OF WELDING
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PRESENTATIONS

3 Experimental Study of Measures Preventing Welders from Fume Exposure (VIII2344-22) by Stephan Egerland.

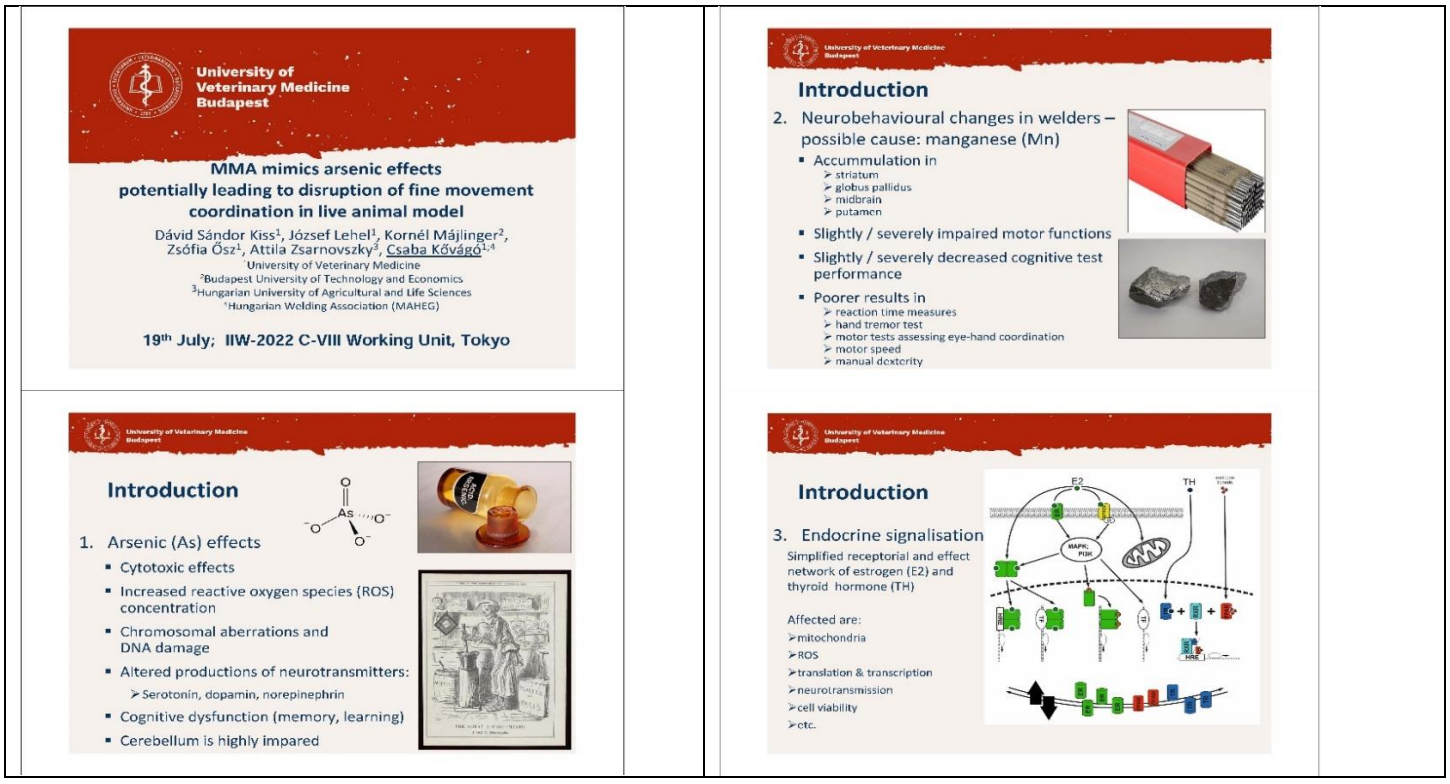
S. A. Egerland, M. Wiesinger, R. Sharma, and B. Ebert, Fronius International, Wels, Austria ISF - Welding and Joining Institute, Aachen University of Technology, Germany

Abstract

Fume emission in arc welding, particularly applying consumable electrode processes, can be reduced, however, practically not entirely be eliminated. A variety of technological means, developed to achieve worker protection, makes it di-cult for the user quantitatively to evaluate their effectiveness. By using advanced Metal-Active-Gas (MAG)-process variants under boundary conditions assumed frequently found in the industry, this study aimed at quantifying efficiency and, in the event of used in combination, the degree of interaction of technical measures for welding fume protection. An approach involving measurement of fume emission rate, determination of specified chemical elements, and evaluation of exposure rates was used, therefore. Data considered useful to those in charge of deciding which measure may provide efficient protection were derived and are discussed. In addition, `environmental background' effects, apart from the actual welding process applied, are suggested to take into greater account because of affecting measurement output.

Keywords: welder health protection, fume extraction torch, powered air-purifying respirator, welding fume emission, fume exposure

4 MMA mimics arsenic effects potentially leading to disruption of fine movement coordination in live animal model (VIII-2347-22) by Dr. Csaba Kovago



University of Veterinary Medicine Budapest

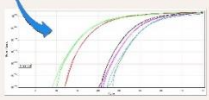
Scientific goals

- The goal of our study was to compare the effects of acute MMA fume inhalation and subtoxic As exposure on the main endocrine signalling pathways in some possibly affected brain areas, on a cellular level, in an in vivo rodent model

University of Veterinary Medicine Budapest

Materials and methods

- Gene expression assesment
  - qRT-PCR
  - Target organ:
    - cerebellum
  - Target mRNA:
    - thyroid receptor (TR) α, β
    - estrogen receptor (ER) α, β
  - Calculation
    - Control group gene expression rate = 1



University of Veterinary Medicine Budapest

Materials and methods

Treatment:

- MMA:
  - Adult BALB-C mice, 4/group
  - Str. steel: ESAB 46.00, 80A; 4h
  - Incubation: 24h; 96h

- As
  - 18 days old BALb-C animals, 3/group
  - Intraperitoneal injection; 40 µg/5 mg/10 mg (bwkg) groups
  - Incubation: 6h

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Results

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Results

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Results

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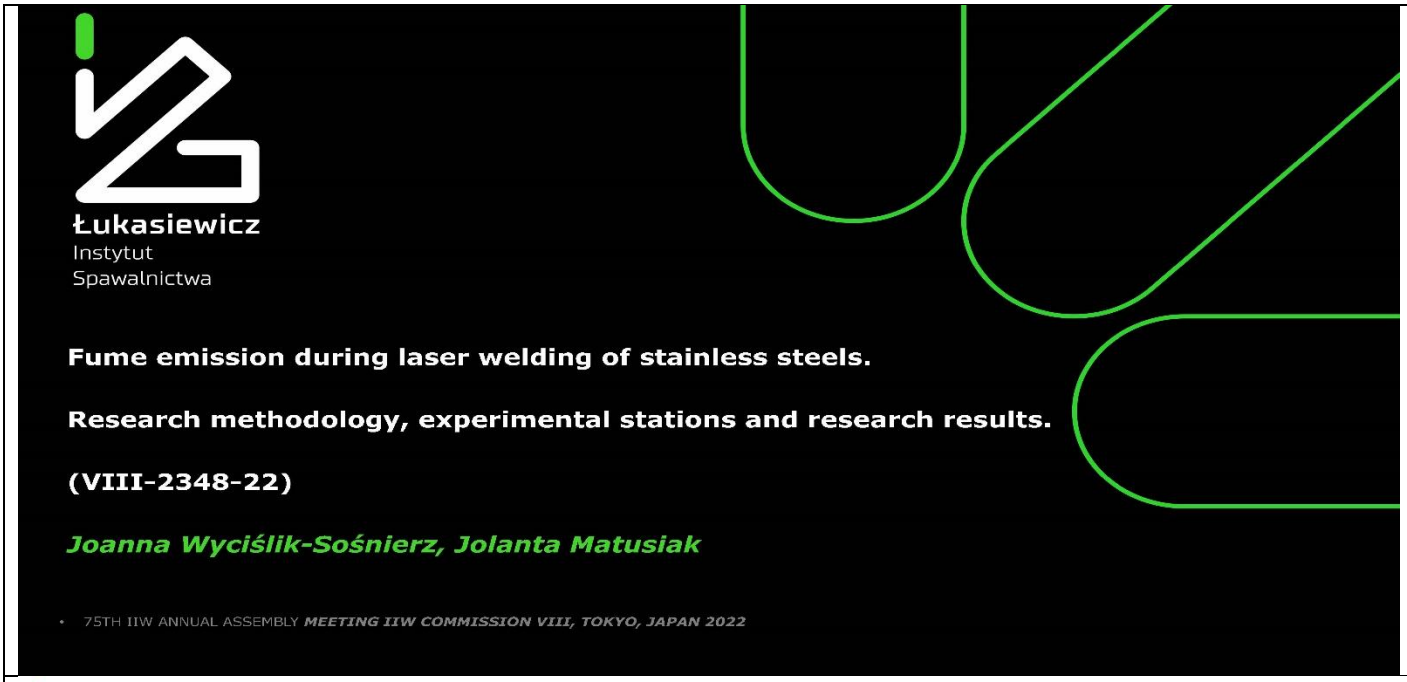
Results

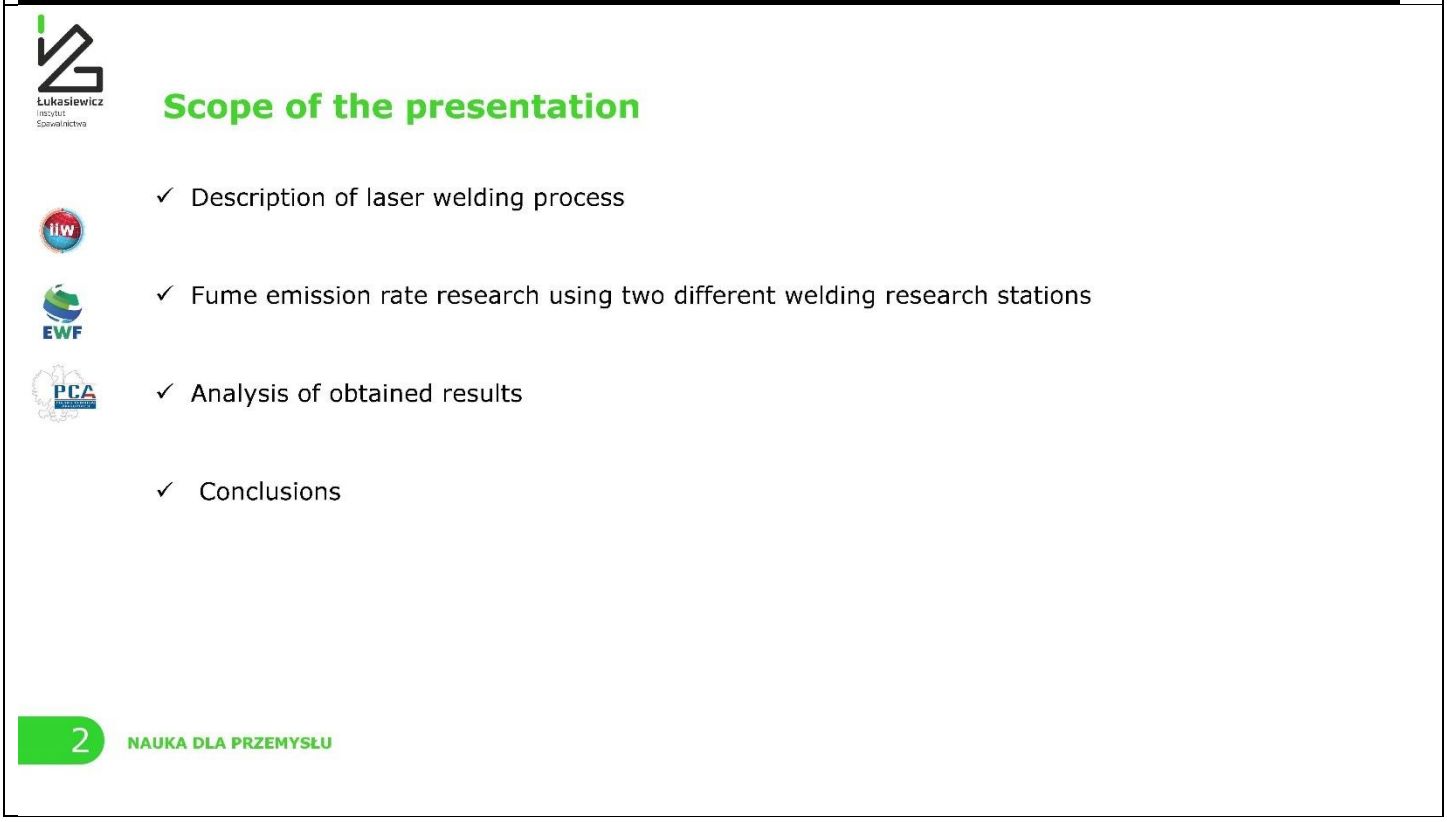
University of Veterinary Medicine Budapest

Conclusions

- **Welding fume** acts as **endocrine disruptor** in the cerebellum
- **Mn accumulates** in **cerebellum** during 60 days of welding-fume exposure (Yu *et al.*, 2003)
- **As** induces abnormal **morphologic** changes in cerebellum; significantly lowered **TRβ expr.**; impairing **motor learning** and memory (Guan *et al.*, 2016) **~ Mn-induced disruption in motor functions**
- **As** significantly downregulates the **energy-expenditure and viability** in cerebellar cells (Manthari *et al.*, 2018)

5 **Fume emission during laser welding of stainless steels. Research methodology, experimental stations, and research results (VIII-2348-22)** by Joanna Wyciślik– Sośnierz and Jolanta Matusiak





Conclusions

- Fume emission rate during laser welding depends on welding technique (heat conduction and deep penetration welding) and technological parameters (laser beam power and welding speed).
- Heat conduction welding technique is more advantageous in the aspect of FER reduction.
- The following correlations between technological parameters and FER were determined:
  - ✓ Positive correlation between laser beam power and FER;
  - ✓ Negative correlation between welding speed and FER.
- Above correlations were determined for both laser welding techniques.

Bibliography

[1] *Górka J.:* Assessment of the Effect of Laser Welding on the Properties and Structure of TMCP Steel Butt Joints *Materials* 2020, *13*(6), 1312; https://doi.org/10.3390/ma13061312

[2] https://www.sciencedirect.com/topics/materials-science/laser-beam-welding

[3] *Banasik M., Dworak J.:* Spawanie elektronowe i laserowe, Poradnik inżyniera. Spawalnictwo tom 2, WNT 2005

[4] *Stano S., Urbańczyk M., Dworak J.* Spawanie laserowe – materiały szkoleniowe IWE, Gliwice, 2022

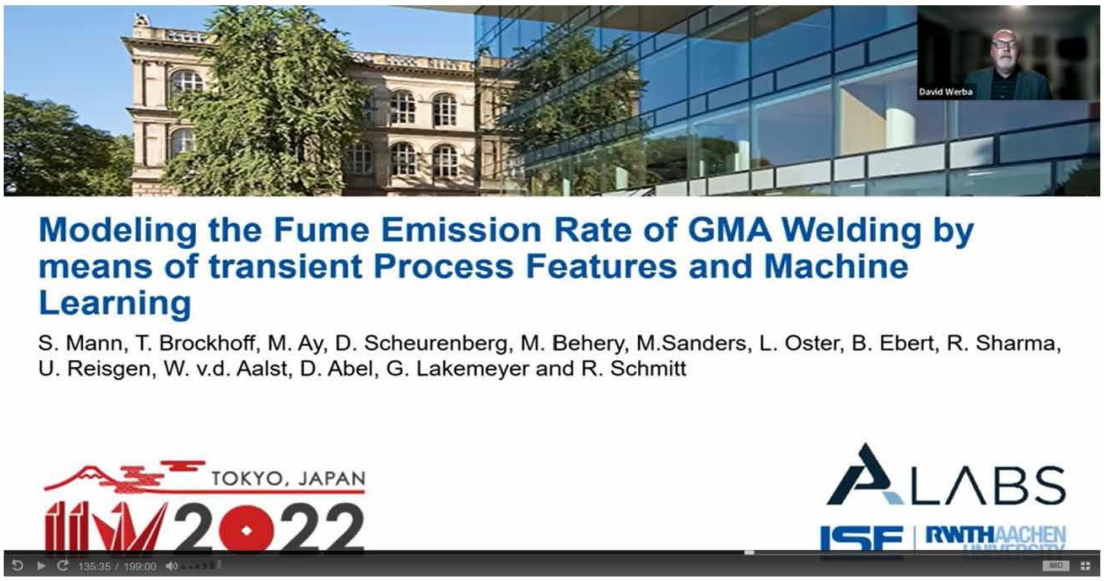
[5] *Matusiak J., Wyciślik-Sośnierz J.:* Opracowanie innowacyjnej technologii spawania łukowego i laserowego wraz z określeniem ich wpływu na emisje do atmosfery i środowiska pracy, Praca badawcza Instytutu Spawalnictwa nr Ma-44 (B-319/19), Gliwice, 2019

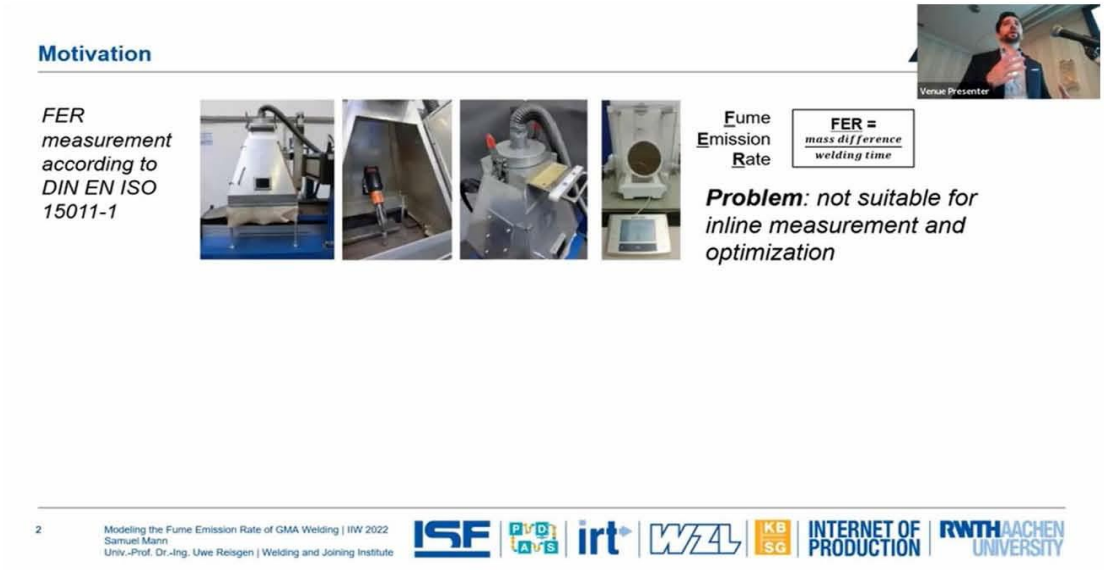
[6] *Wyciślik-Sośnierz J., Matusiak J.:* Ocena ekologiczna procesu spawania laserowego i hybrydowego laser + MIG stali odpornych na korozję o mikrostrukturze austenitycznej, Praca badawcza Instytutu Spawalnictwa nr Ma-46 (ST-32/21), Gliwice, 2021

[6] https://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/

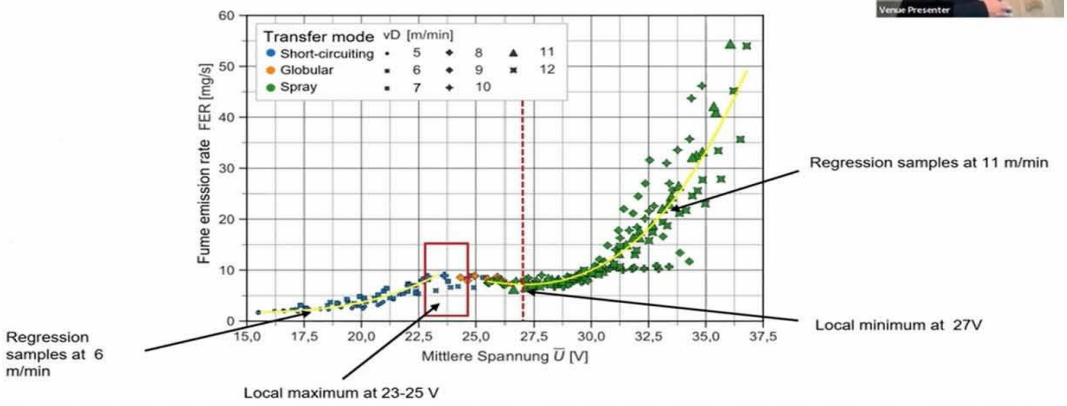
6 Coffee Break

7 Modeling the Fume Emission Rate of GMA Welding by means of transient Process Features and Machine Learning (VIII-2346-22) by Samuel Mann

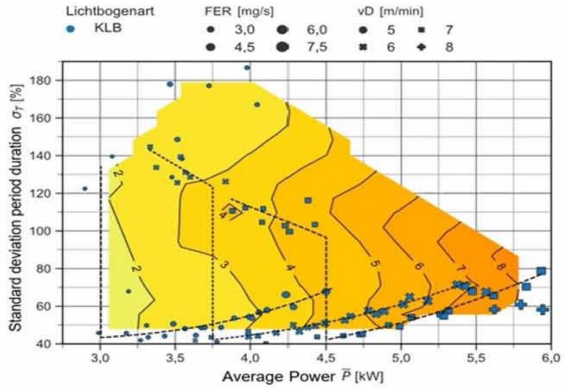

David Werba
Modeling the Fume Emission Rate of GMA Welding by means of transient Process Features and Machine Learning
S. Mann, T. Brockhoff, M. Ay, D. Scheurenberg, M. Behery, M.Sanders, L. Oster, B. Ebert, R. Sharma, U. Reisgen, W. v.d. Aalst, D. Abel, G. Lakemeyer and R. Schmitt
TOKYO, JAPAN
IIW2022
ALABS
ISF | RWTH AACHEN UNIVERSITY
135:35 / 199:00

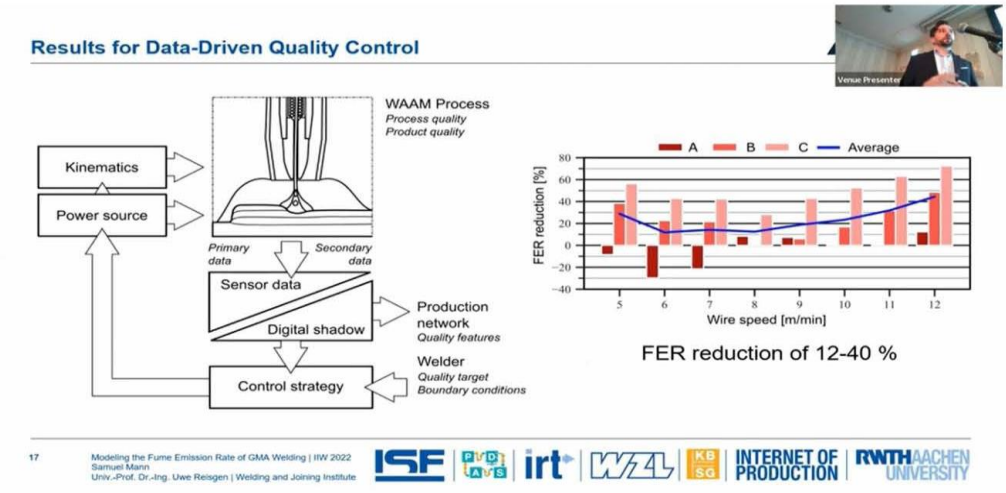

Motivation
Venue Presenter
FER measurement according to DIN EN ISO 15011-1
Fume Emission Rate
FER = mass difference / welding time
Problem: not suitable for inline measurement and optimization
2
Modeling the Fume Emission Rate of GMA Welding | IIW 2022
Samuel Mann
Univ.-Prof. Dr.-Ing. Uwe Reisgen | Welding and Joining Institute
ISF | PVD LAVS | irt | WZL | KB SG | INTERNET OF PRODUCTION | RWTH AACHEN UNIVERSITY

4 Step FER Modeling



Lower Process Boundaries




Results for Data-Driven Quality Control
Venue Presenter
Kinematics
Power source
WAAM Process
Process quality
Product quality
Primary data
Secondary data
Sensor data
Digital shadow
Production network
Quality features
Welder
Quality target
Boundary conditions
Control strategy
A
B
C
Average
FER reduction [%]
Wire speed [m/min]
FER reduction of 12-40 %
17
Modeling the Fume Emission Rate of GMA Welding | IIW 2022
Samuel Mann
Univ.-Prof. Dr.-Ing. Uwe Reisgen | Welding and Joining Institute
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Outlook
Venue Presenter
Connected Fume Sensor
Qualified and highly accessible fume exposition data
Data Driven Quality Control
Model based fume emission data and fume emission minimization
18
Modeling the Fume Emission Rate of GMA Welding | IIW 2022
Samuel Mann
Univ.-Prof. Dr.-Ing. Uwe Reisgen | Welding and Joining Institute
INTERNET OF PRODUCTION
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8 Development and calibration of a database-driven fine dust sensor system for online measurement of welding fume exposure (VIII-2349-22) by Benjamin Ebert, Rahul Sharma, Julian Blakert and Uwe Reisgen

Benjamin Ebert, Rahul Sharma, Samuel Mann, Julian Blakert, Uwe Reisgen Welding and Joining Institute, RWTH Aachen University, Aachen, Germany

Abstract

The generation of welding fumes is an unavoidable fact in many welding processes. Exposure to particulate hazardous substances can lead to damage to the human organism, which depends on the chemical composition and the number and size of the particles. The relationship between welding fume emission and exposure is extremely complex and influenced by numerous and partly non-deterministic factors. Due to the non-trivially predictable welding fume exposures and frequently decreasing exposure limits, there is a need for flexible measuring systems that can quantify the welding fume exposures over a wide area. However, existing devices for measuring welding fume exposure are often cost-intensive, too large, do not allow near-real-time measurements and have a low temporal resolution. For this reason, a low-cost sensor system was developed on the basis of opensource software that can reproduce a locally resolved, real-time and multidimensional image of the particle/welding fume concentration. The sensor unit consists of a photometric fine dust sensor, which shows linear behavior in a wide range of concentration. Therefore, calibration factors could be determined in the laboratory for GMAW process with different materials using a reference measuring device. The calibration was then validated in practical exposure tests. As part of further data processing, a network was set up in which the sensors in combination with microcontrollers can store measurement data in a database via WLAN. These can be visualized nearly in real time via a program and can be exported at any time. Due to the use of the MQTT protocol, the developed system is almost infinitely scalable and can also be expanded with sensors for other measurement variables. In industrial applications, the usability of the sensors for a locally resolved two-dimensional quantification of the welding fume exposure could be demonstrated. The case analyzed demonstrates the possibilities that arise from sensor integration and networking of production systems.

9 Closure of day 1 and review of Agenda (VIII-2343-22) for day 2

10 Bacterial infections with Bacillus cereus species – misleading information suggesting a typical occupational disease in welders (VIII-2350-22) by Dr. Wolfgang Zschiesche and Dr. Simon Weidhaas

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Welder´s Anthrax

Review

Welder's Anthrax: A Review of an Occupational Disease

Marie A. de Perio [1,*], Katherine A. Hendricks [2], Chad H. Dowell [3], William A. Bower [2], Nancy C. Burton [4], Patrick Dawson [5], Caroline A. Schrodt [6], Johanna S. Salzer [7], Chung K. Marston [2], Karl Feldmann [4], Alex R. Hoffmaster [2] and James M. Antonini [8]

Abstract: Since 1997, nine cases of severe pneumonia, caused by species within the *B. cereus* group and with a presentation similar to that of inhalation anthrax, were reported in seemingly immunocompetent metalworkers, with most being welders. In seven of the cases, isolates were found to harbor a plasmid similar to the *B. anthracis* pXO1 that encodes anthrax toxins. In this paper, we review the literature on the *B. cereus* group spp. pneumonia among welders and other metalworkers, which we term welder's anthrax. We describe the epidemiology, including more information on two cases of welder's anthrax in 2020. We also describe the health risks associated with welding, potential mechanisms of infection and pathological damage, prevention measures according to the hierarchy of controls, and clinical and public health considerations. Considering occupational risk factors and controlling exposure to welding fumes and gases among workers, according to the hierarchy of controls, should help prevent disease transmission in the workplace.

Keywords: *Bacillus*; welder; welder's anthrax

Pathogens 2022; 11: 402 - *https://www.mdpi.com/2076-0817/11/4/402*

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Welder´s anthrax – Overall literature

- further descriptions of infections with B. cereus group in welders and metal workers, small in numer
- other publications of infections acquired from contaminated soil. Casereports of B. cereus infections in immunocompent people unrelated to occupational activities.
- „There is no conclusive explanation, thus far, for the strong relationship existing between the professonal category of metal workers and B. cereus lung infection. [...] it is impossible to link such clinical episodes with any environmental sources of B. cereus." (Savini V. Bacillus cereus pneumonia: In: The diverse faces of bacillus cereus, 73-83. Elesevier, Amsterdam, 2016

IPA RUB

Welder´s anthrax – an occupational disease?-

Are 9 case reports over 25 years sufficient evidence to constitute an occupational disease?

- Only one match of clinically identified b. cereus and environmental isolate
- B. cereus is a frequent contaminant in samples
- Risk of b. cereus pneumonia vs. possible side effects of PrEP vaccination if applied on a broader welders' population
- B. cereus (including anthrax) infections are also described in occupational situations other than welding

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Conclusions

- The headline „Welder‘s anthrax – a review on an occupational disease“ may be misleading in public reception
- It suggests a supposedly „typical“ disease in welders by infections of the B. cereus group that in fact does not exist.
- There is some concern in the welding community that the risk could be overestimated in public reception.
- It has been suggested to write a respective letter to the editors of the journal.

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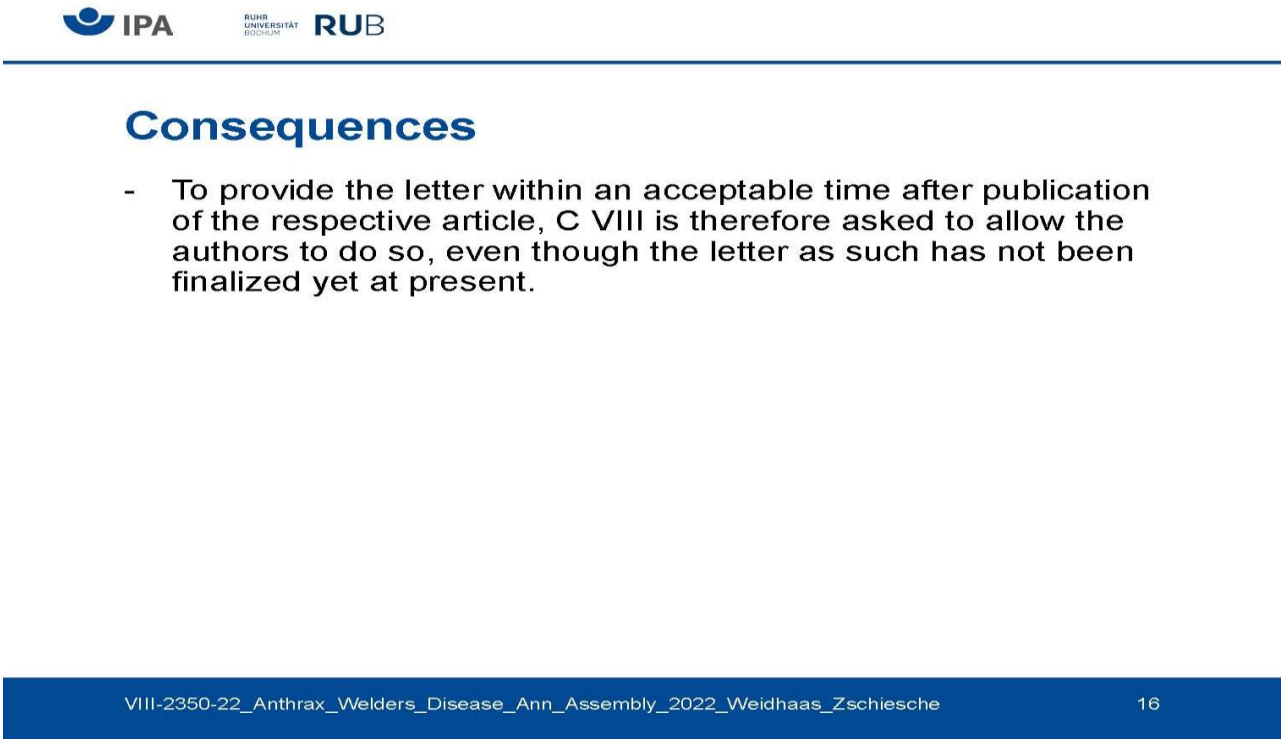
Consequences

- A letter to the editors of the journal is planned to be issued
- Herein the level of epidmiolgical evidence of the case reports on B. cereus/anthrax pneumonia shall be adressed especially when compared to current knowledge on other infectious disease in welders with a more solid epidemiological background and more known mechanistic detail.
- Clarification that a few cases over decades from our point of view do not constitute a typical welder´s disease
- The authors of this presentation are prepared to write a letter in this sense on behalf of Commission VIII



11 **Reducing fume exposure of welders in Gas Metal Arc Welding – sustainable integrative approach in Germany (VIII-2351-22)** by Dr. Wolfgang Zschiesche and Dr. Simon Weidhaas

Abstract

In the light of the IARC evaluation of welding fumes as carcinogenic to humans and the worldwide reduction of allowable workplace concentrations of pollutants, it is obvious that tremendous effort is needed to reduce fume exposure of welders to a minimum. In Germany, a multi-disciplinary project “REarc” is under way that covers all aspects of fume reduction with a long-term approach. It has meanwhile made big strides.

The presentation will provide the present state of progress that includes e. g.: reduction of the overall fume emission and of particular fume components regarding welding parameters and shielding gases; improvement of fume capture devices; more detailed documentation of fume measurements; coordination of research activities; promotion of detailed information to those who should be addressed, including different forms of media; integration of those responsible for health and safety at the workplaces into the project, including the respective professional technical and medical societies; providing branch and industry specific guidelines, including also quality aspects (e. g. for lung function tests, biological monitoring); developing mathematical models of the influence of welding and hygiene parameters on the expectable fume concentrations; verifying the effects of the proposed interventional means in the frame of interventional field studies.

Authors

Wolfgang Zschiesche, Simon Weidhaas.

Institute for Prevention and Occupational Medicine of the German Social Accident Insurance, Bochum, Germany

Corresponding author – e-mail address
wolfgang.zschiesche@dguv.de

12 Warnings for welding consumables - proposals for an International Standard (VIII2352-22) by Mauro Carabelli

13 Coffee Break

14 National Reports:

Australia – Bruce Cannon Weld Australia presenting:

Item #1

The item involved in the accident was an electrically driven welding positioner, incorporating a rotatable circular steel table approximately 900mm in diameter. The table contains slots that are used to locate and secure a steel holding fixture, which in turn is used to mount the workpiece to be welded. The positioner was supplied by a company called Methods Equipment Pty Ltd (no longer in business). The root cause of the accident was found to be failure of the bolts that fasten the holding fixture on to the table (slots). This in turn was caused by using bolts that were too short to engage fully with the nut, thereby over stressing the section of thread that was engaged. There is enforcement on this incident and the company has with regulatory approval opted to provide welding safety training in 2 parts; Part 1 will be for welders; Part 2 will be a similar program tailored to supervisory personnel.

Item #2

An Australian regulatory body has involved 2 national universities investigating the efficacy of welding fume control in the workplace. This is intended to be a 2-year study.

Item #3

The Australian Standard Association will be revising the Australian Standard on Fire Precautions in the workplace. The existing standard is approximately 20 years old. This project is forecast to take 2 years to be completed.

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Canada – Dave Hisey CWB Group Reporting

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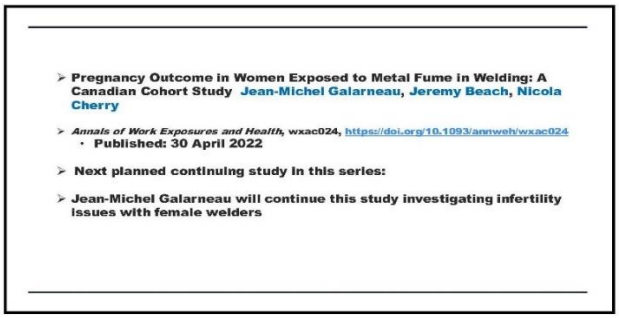

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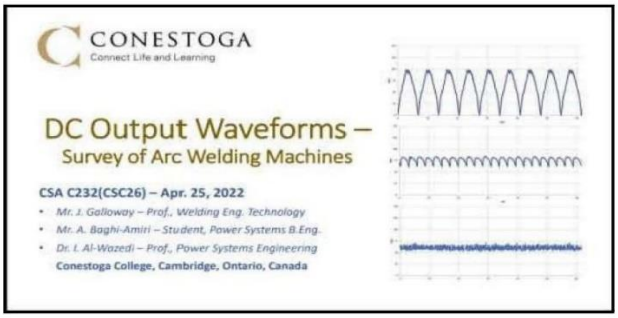

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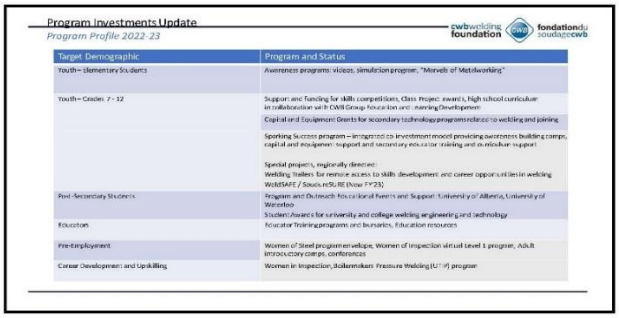

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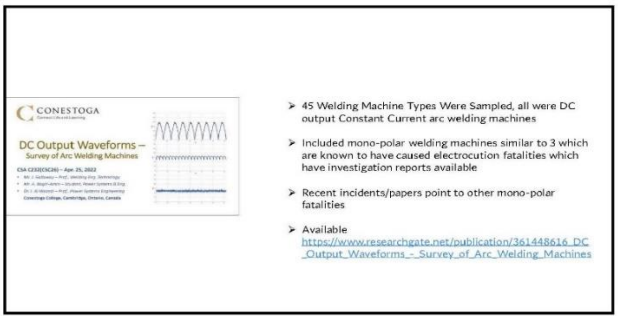

China – Hong Li Beijing University of Technology presenting

Recent Progress of Welding Environment, Health, and Safety in China
This was a rather detailed prepared report of various green welding projects underway at various universities across China

Slide Title: Energy-saving and environment-friendly welding processes: Electromagnetic Induction Heating System and Application in the Preheating & PWHT Vessels and Pipes Welding in Nuclear Power Plants by Qingdao University of Technology. This was promoted as a Green Process, reduced energy consumption, no emitting fumes or CO_2, no open flame and reduced electricity expense

Slide Title: Deep Penetration Back Welding for medium and heavy welding by Lanzhou University of Technology (LUT)
One-side welding with back formation. The high-frequency pulsed arc force is used to further increase the heat input of the molten pool, overcome the surface tension of the back molten pool, and the arc penetrates the molten pool to form a molten hole.

Slide Title: Energy-saving and environment-friendly welding process
High efficiency GMAW with cable-type wires and applications by Jiangsu University
No need for external mechanical wire swing or electro-magnetic devices the arc rotates autonomously
Pulsed PAW cable-type seven wires MIG hybrid welding

Slide Title: Non-Copper Coated GMAW Wire and Applications by Hebei Xingyu Welding Co.
This slide showed non-copper coated barrel wire production line, mechanical descaling, an Arc Waveform Comparison chart comparing copper coated wire and non-copper coated wire; triple acid-free washing tank; rainwater recycling system. They claimed Environmental protection + Energy saving + High efficiency + Save Space + Improve productivity + Reduce workers + Reduce costs

Slide Title: Conclusion & Outlook
Regards to the national strategic goals of "Carbon Peak" and "Carbon Neutrality", more and more new welding technology and welding consumables characterized by energy saving, environmental protection, low cost, and high efficiency are developed. Energy-saving and environment-friendly welding consumables has an important influence on safety and effective protection of employees in the welding field. Energy saving and environmentally friendly welding process and technology, as well as green & sustainable welding consumables has an important influence on green manufacturing, intelligent upgrading and the safety and intelligent protection of employees in the welding field.

Minimum energy consumption; Maximum environmental benefits; Highest process efficiency; Minimum material wastage; Sustainable welding process; Minimum resources; Maximum cost saving

China’s current environmental targets in welding: By 2025 Lower carbon intensity; By 2030 Peak carbon; By 2060 Carbon neutrality

Japan

Satoshi Yamane, Saitama University Presenting: National Report from Japan; National regulation concerning welding fume

The national regulation Ordinance on Prevention of Hazards Due to Specified Chemical Substances has been changed. Welding fume is classified as a Specified Chemical Substance; Manganese is treated separately and the exposure limit for manganese is 0.05mg/m^3. Welding has been divided into separate categories, Indoor Welding and Outdoor Welding

Indoor Welding Requirements: Welding fume must be measured in the breathing zone and protection provided to keep manganese below the prescribed limit. Fit testing of breathing protection is required every year for each welder according to ISO 16975-3:2017

Outdoor Welding Requirements: A respiratory protection device is required with an effective collection range of 95%

There is now a requirement for **"Specified chemical substance work supervision"**. The person shall have completed the "Technical Skills Training Course for Chief Workers". This had an effective date of Aprl 1, 2022.

6 Month Mandatory Medical Checkup

Anyone working with "Specified chemical substance" which includes welders, will have a mandatory medical checkup by a physican once every 6 months.

USA David Werba Presenting:

Item 1: Adoption of Globally Harmonized System of Classification and Labelling of Chemicals (GHS7)

a. US Occupational Safety and Health Administration (OSHA) is in the proces of aligning the federal hazard communication (HazCom) stanadard with GHS 7 chemical labels and classification and with the Canadian WHMIS regulations.
b. OSHA recently stated that the earliest possible adoption of the final rule would be December 2022

Item 2: National Fire Portection Association (NFPA) 51B Standard for Fire Prevention During Welding, Cutting and Other Hot Work is under revision

15 Preparation for the Intermediate Meeting

- Topics for Agenda

16 Any other business

17 Closure of day 2 and review of Agenda (VIII-2343-22) for day 3, joint meeting with C-II.

18 Closure of meeting

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Day 3 was combined with C II, but presentations were a repeat of Day 2

19 Opening: C-II: Zhuyao Zhang, C-VIII: David Werba

- **a.** Welcome and general information about the meetings
- **b.** Review and adoption of the agenda (VIII-2343-22)

20 Warnings for welding consumables - proposals for an International Standard (VIII2352-22) by Mauro Carabelli

21 Reducing fume exposure of welders in Gas Metal Arc Welding – sustainable integrative approach in Germany (VIII-2351-22) by Dr. Wolfgang Zschiesche and Dr. Simon Weidhaas

22 Any other business

23 Closure of meeting

ANNEX A is carried forward from previous meetings for your information

Annex A

Title	Document Number	Author(s)	Year
Contact lens use in industry	VIII-1588-91; IIW-1124-91	ZSCHIESCHE W.	1991
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