Patricio F. Mendez, Ph.D.
Professor
Weldco/Industry Chair in Welding and Joining
Director, Canadian Center for Welding and Joining
Department of Chemical and Materials Engineering
University of Alberta
ECERF W7-092
9107 116th St.
Edmonton, AB T6G 2V4
Canada
office: (780)248-1587
cell: (780)938-1587

UNIVERSITY OF ALBERTA

September 15, 2013

This is my report as Expert in C XII and SG 212. Attached are the agendas of both commissions. From the presentations and conversations at SG 212, it is clear that Germany and Japan are leading in investigating arc plasma. There is currently no research in the topic outside there; however, understanding the arc might have enormous implications of cost and quality. Prof. Rick Sydora, from the Dept. of Physics of UofA joined the SG 212 to learn about welding (he comes from a plasma fusion background). We're working on having a line of work on welding arc in Canada.

C XII involved many papers on laser-assisted welding. It is unclear if the interest is only academic or industry-driven. In any case, lasers are something to deserves attention.

I also gave an invited talk (the only one at the session) at SG RES. The focus was on turning welding into engineering tools. It seems to have started a conversation in the community; if so, it will very beneficial to industry, education, and research. The agenda of SG RES is also attached.

INTERNATIONAL INSTITUTE OF WELDING
A world of joining experience

Doc.XII-2149r2-13

Annual Assembly 2013

Draft Agenda rev.2
Commission XII "Arc Welding Processes and Production Systems"
September 12-14, 2013
Congress Centre Essen, Essen, Germany

Thursday 12 Sept. 2013, 14.00h – 18.00 h, Room: Berlin (Floor 2)

1. Opening

2. Agenda

3. Brief report on intermediate meeting in Netherlands in April, 2013

4. Presentation of documents:

[1] Machine vision system for online weld pool observation of gas metal arc welding processes
U. Reisgen, M. Purrio, G. Buchholz, K. Willms (Germany)
Doc.XII-2126-13

[2] Tracking of Welding Line and Standoff Control in Plasma Welding by using CCD camera
S.Yamane, H.Suzuki, J.Toma, K.Hosoya, T.Nakajima, H.Yamamoto (Japan)
Doc.XII-2140-13

[3] Efficient gap filling in MAG welding by using optical sensors
M. Ebert-Spiegel, S-F.Goecke, M.Rethmeier (Germany)
Doc.XII-2124-13

[4] The Effect of the Metal Transfer Stability (Spattering) on Fume Generation, Morphology and Composition in Short-Circuit MAG Welding
V.A. de Meneses, J.F.P.Gomes, A.Scotti (Brazil)
Doc.XII-2107-13/212-1261-13

[5] Study on the Porosity Formation Phenomenon in Fillet Welding of Galvanized Steel Sheets and on Improvement of Weld Quality
S.Izutani, K.Yamazaki, R.Suzuki, Y.Ueda,K.Nakamura, T.Uezono (Japan)
Doc.XII-2128-13

Coffee Break

[6] Change and Trend of Welding Technology in Japan based on Questionnaire Survey
S.Asai, et al. (Japan)
Doc.XII-2127-13

[7] Characterization of Process Behavior in Transition Gas Metal Arc Welding
S. Herudek, K. Rohrs, S. Willinghofer, S. Rose, U. Fussel (Germany)
Doc.XII-2143-13

[8] Correction by GTAW on girth welded joints for severe sour gas pipelines
T.Morimoto, F.Kimura, N.Yamana, T.Torii (Japan)
Doc.XII-2150-13

[9] Improvement of welding quality and productivity using cold tandem GMA process
T.Ueyama, T.Era, T.Uezono, H.Shiozaki, N.Takahashi (Japan)
Doc.XII-2121-13

[10] Calorimetric analysis of the comprehensive heat flow of the welding process
A. Hälsig, P. Mayr (Germany)
Doc.XII-2139-13

[11] Control of penetration shape by pulsed current waveform
S.Nonomura,K.Kobayashi,K.Hyoma,H.Yamaoka,F.Miyasaka (Japan)
Doc.XII-2123-13

Friday 13 Sept. 2013, 8.30 h -17.00 h., Room: Berlin (Floor 2)
Joint Meeting of Comm.IV, Comm.XII and SG212

Morning Session 8.30h-12.30h

[12] Fundamental study of narrow gap laser welding with high-frequency laser beam oscillation
Y.Yamazaki, Y.Abe, Y.Hioki, A.Kitagawa, K.Nakata (Japan)
Doc.XII-2139-13/IV-1156-13/212-1299-13

[13] Effect of spatial constraint on plasma plume and process stability during high power CO_2 laser welding
Y.Cai, J.Zhu, Y.Wu, D.Sun, Y.Wu (China)
Doc.XII-2136-13/IV-1155-13/212-1298-13

[14] Analysis of full penetration laser welding of thick plates by CFD simulations
L. J. Zhang, J. X. Zhang, A. Gumenyuk, M. Rethmeier, S.-J. Na (Korea)
Doc.XII-2148-13/IV-1158-13/212-1290-13

[15] Observation of the dynamic behaviors of keyhole exit in controlled-pulse keyholing plasma arc welding
C.S. Wu, Z.M. Liu, G.K. Zhang (China)
Doc.XII-2135-13/IV-1142-13/212-1282-13

Coffee Break

[16] Experimental study of Magnetic Arc Blow for Plasma Arc Cutting
Y.Yamaguchi, Y.Katada, T.Itou, Y.Uesugi, Y.Tanaka, T.Ishijima (Japan)
Doc.XII-2119-13/IV-1157-13/212-1273-13

[17] Laser-assisted Preheating during mechanized GMAW of Magnesium-alloys
K. Schricker, K.Günther, F.Petzoldt, J.P.Bergmann (Germany)
Doc.XII-2145-13/IV-1124-13/212-1291-13

[18] Phenomena and suppression conditions of spattering during laser and hybrid welding
S. Katayama, M. Mizutani, Y. Kawahito (Japan)
Doc.XII-2133-13/IV-1132-13/212-1284-13

[19] Influences on the strength of laser GMA hybrid welded joints in the case of sheet thicknesses to 40 mm
G. Wetzel, J. Neubert, B. Kranz (Germany)
Doc.XII-2132-13/IV-1137-13/212-1283-13

Afternoon Session 14.00h-17.00h

[20] Fiber laser - MIG arc hybrid welding of thick titanium plates
J. Liao, N. Yamamoto K. Nakata (Japan)
Doc.XII-2134-13/IV-1129-13/212-1285-13

[21] Large spot laser assisted MIG arc brazing-fusion welding of aluminum alloy to galvanized steel
G. Qin, Z. Lei, Y. Su, J. Gao, S. Wang, S. Lin (China)
Doc.XII-2131-13/IV-1139-13/212-1277-13

[22] Effect of process parameters on joint properties in laser MIG hybrid welding of thin-sheet fillet welds on 22MnB5
F.Möller, C. Mittelstädt, S.Kötschau, C.Thomy, S.-F. Goecke, F.Vollertsen (Germany)
Doc.XII-2129-13/IV-1138-13/212-1276-13

[23] Laser Arc Hybrid Welding for Large-Sized Thin Plate Structures Made of High Tensile Steel
H.Matsuo, K.Yamamoto, K. Yamamoto, K.Oowaki, I.Kawaguchi (Japan)
Doc.XII-2146-13/IV-1128-13/212-1292-13

Coffee Break

- Short presentation by IIW CEO -

[24] Comparison of CMT with other arc modes for laser arc hybrid welding of 7 mm steel
J. Frostevarg, A. Kaplan, J. Lamas (Sweden)
Doc.XII-2147-13/IV-1135-13/212-1293-13

[25] Effect of Laser-MIG hybrid welding parameters on properties of welded HSLA sheets for automotive applications
S. Chatterjee, R. Mulder, Tony v.d. Veldt (Netherlands)
Doc. XII-2152-13/IV-1150-13/212-1306-13

Saturday 14 Sept. 2013, 14.00 h -18.00 h., Room: Berlin (Floor 2)

[26] Governing Parameters on Fume Generation in Short-Circuit MAG Welding
V. A. de Meneses, A. Scotti (Brazil)
Doc. XII-2125-13

[27] Dynamic Observations of Welding Phenomena in High Frequency Electric Resistance Welding
T.Okabe, T.Kodama, K.Iwazaki, S.Goto, M.Aratani, S.Toyoda, Y.Kato, K.Yasuda, K.Nakata (Japan)
Doc. XII-2130-13

[28] Keyhole welding of mild steel with CF-TIG (cathode focussed GTA)
M. Lohse, S. Rose, U. Füssel, H. Schuster, V. Krink (Germany)
Doc. XII-2141-13

[29] Development of Submerged Arc Welding Method Using Hot-Wire
T. Tsuyama (Japan)
Doc. XII-2120-13

[30] Underwater arc wet welding and statistical analyses with the ANALYSATOR HANNOVER
T. Hassel, V. Hecht-Linowitzki, S. M. Kussike, Fr.-W. Bach, D. Rehfeldt (Germany)
Doc. XII-2151-13

Coffee Break

[31] High deposition rate position welding of Al 5083 alloy for the spherical type LNG tank
C. Kim, Y-N. Ahn, K-B. Lee, D-S. Kim (Korea)
Doc. XII-2144-13

[32] Static versus dynamic arc characteristics in GTAW and GMAW
G. Huismann (Germany)
Doc. XII-2137-13

[33] Leading edge of current waveform control technology on digital inverter controlled welding power source and its peripheral equipment
T.Era, T.Uezono, K.Kadota, T.Ueyama, S.Hata (Japan)
Doc. XII-2122-13

[34] TIG narrow gap welding - new approaches to evaluate and improve the shielding gas coverage and the energy input
M. Häßler, S. Rose, U. Füssel, H.-I. Schneider, C. Werner (Germany)
Doc. XII-2142-13

5. Recommendation of publication for IIW Journal “Welding in the World”

6. Miscellaneous

7. Date and place of next meeting

8. Closure

INTERNATIONAL INSTITUTE OF WELDING
A world of joining experience

Annual Assembly 2013

Doc. 212-1302r3-13

Draft Agenda (3rd Revised version)
Study Group 212 "Physics of Welding"
September 12-14, 2013
Congress Centre Essen, Essen, Germany

Thursday 12 Sept. 2013, 8.30h – 12.30 h, Room: Berlin (Floor 2)

1. Opening

2. Agenda

3. Minutes of previous meeting

4. Brief report on intermediate meeting in Netherlands in April, 2013

5. Presentation of documents:

[1] Variable Polarity TIG Welding of Aluminum Alloy
Jungho Cho and Suck-Joo Na (Korea)
Doc. 212-1289-13

[2] Cathode Fall Voltage of TIG Arcs from A Non-equilibrium Arc Model
Dirk Uhrlandt, Margarita Baeva, Ruslan Kozakov, Gregor Goett (Germany)
Doc. 212-1304-13

[3] Characteristics of TIG welding process with constricted nozzle
K. Konishi, M. Tanaka, A. Murata and T. Murata (Japan)
Doc. 212-1297-13

[4] Numerical Analysis of Welding Process Using Particle Method
S.Saso, M. Mouri, M. Tanaka, S. Koshizuka (Japan)
Doc. 212-1274-13

[5] Analyse of Molecule Gas Admixture in A Sprayed Arc
Gregor Goett, Heinz Schoepp, Dirk Uhrlandt (Germany)
Doc. 212-1303-13

[6] Numerical simulation of radiative transfer in GMAW
M. Hertel, S. Jäckel, A. Spille-Kohoff, U. Füssel, S. Rose (Germany)
Doc. 212-1294-13

[7] 3D Numerical Model of Short-Circuiting Transfer in GMAW
K.Hashimoto, Y.Hirata, K.Kadota (Japan)
Doc. 212-1300-13

[8] Numerical analysis of rotating transfer by a 3D electromagnetic liquid transfer model
Y. Ogino, Y. Hirata, S. Kihana, N. Nitta (Japan)
Doc. 212-1296-13

[9] CFD simulation of submerged tandem arc welding process
Daewon Cho, Degala Venkata Kiran, Woo-Hyun Song, Suck-Joo Na (Korea)
Doc. 212-1286-13

Friday 13 Sept. 2013, 8.30 h -16.00 h., Room: Berlin (Floor 2)
Joint Meeting of Comm.IV, Comm.XII and SG212

Morning Session 8.30h-12.30h

[10] Fundamental study of narrow gap laser welding with high-frequency laser beam oscillation
Y.Yamazaki, Y.Abe, Y.Hioki, A.Kitagawa, K.Nakata (Japan)
Doc.XII-2139-13/IV-1156-13/212-1299-13

[11] Effect of spatial constraint on plasma plume and process stability during high power CO2 laser welding
Y.Cai, J.Zhu, Y.Wu, D.Sun, Y.Wu (China)
Doc.XII-2136-13/IV-1155-13/212-1298-13

[12] Analysis of full penetration laser welding of thick plates by CFD simulations
L. J. Zhang, J. X. Zhang, A. Gumenyuk, M. Rethmeier, S.-J. Na (Korea)
Doc.XII-2148-13/IV-1158-13/212-1290-13

[13] Observation of the dynamic behaviors of keyhole exit in controlled-pulse keyholing plasma arc welding
C.S. Wu, Z.M. Liu, G.K. Zhang (China)
Doc.XII-2135-13/IV-1142-13/212-1282-13

Coffee Break

[14] Experimental study of Magnetic Arc Blow for Plasma Arc Cutting
Y.Yamaguchi, Y.Katada, T.Itou, Y.Uesugi, Y.Tanaka, T.Ishijima (Japan)
Doc.XII-2119-13/IV-1157-13/212-1273-13

[15] Laser-assisted Preheating during mechanized GMAW of Magnesium-alloys
K. Schricker, K.Günther, F.Petzoldt, J.P.Bergmann (Germany)
Doc.XII-2145-13/IV-1124-13/212-1291-13

[16] Phenomena and suppression conditions of spattering during laser and hybrid welding
S. Katayama, M. Mizutani, Y. Kawahito (Japan)
Doc.XII-2133-13/IV-1132-13/212-1284-13

[17] Influences on the strength of laser GMA hybrid welded joints in the case of sheet thicknesses to 40 mm
G. Wetzel, J. Neubert, B. Kranz (Germany)
XII-2132-13/IV-1137-13/212-1283-13

Afternoon Session 14.00h-16.00h

[18] Fiber laser - MIG arc hybrid welding of thick titanium plates
J. Liao, N. Yamamoto K. Nakata (Japan)
XII-2134-13/IV-1129-13/212-1285-13

[19] Large spot laser assisted MIG arc brazing-fusion welding of aluminum alloy to galvanized steel
G. Qin, Z. Lei, Y. Su, J. Gao, S. Wang, S. Lin (China)
Doc.XII-2131-13/IV-1139-13/212-1277-13

[20] Effect of process parameters on joint properties in laser MIG hybrid welding of thin-sheet fillet welds on 22MnB5
F.Möller, C. Mittelstädt, S.Kötschau, C.Thomy, S.-F. Goecke, F.Vollertsen (Germany)
Doc.XII-2129-13/IV-1138-13/212-1276-13

[21] Laser Arc Hybrid Welding for Large-Sized Thin Plate Structures Made of High Tensile Steel
K.Yamamoto, H.Matsuo, K. Yamamoto, K.Oowaki, T. Sugino (Japan)
Doc.XII-2146-13/IV-1128-13/212-1292-13

Coffee Break

[22] Comparison of CMT with other arc modes for laser arc hybrid welding of 7 mm steel
J. Frostevarg, A. Kaplan, J. Lamas (Sweden)
Doc.XII-2147-13/IV-1135-13/212-1293-13

[23] Effect of Laser-MIG hybrid welding parameters on properties of welded HSLA sheets for automotive applications
S. Chatterjee, R. Mulder, Tony v.d. Veldt (Netherlands)
Doc.XII-2152-13/IV- -13/212-1306-13

Saturday 14 Sept. 2013, 8.30 h -12.30 h., Room: Berlin (Floor 2)

[24] Temperature Measurement of Asymmetrical Pulsed TIG Arc Plasma by Multidirectional Monochromatic Imaging Method
Kazufumi Nomura, Takashi Kishi, Kentaro Shirai and Yoshinori Hirata (Japan)
Doc. 212-1305-13

[25] Influence of System Factors on Energy Consumption During Resistance Welding
Jerry E. Gould (USA)
Doc. 212-1288-13

[26] A general model for electrode extension and its application to tubular wire and hot wire processes
Patricio F. Mendez (Canada)
Doc. 212-1301-13

[27] Arc voltages on the GMAW process with and without current pulse, estimation of the dynamics for argon 18%CO2 shielding gas
Gerd Huismann (Germany)
Doc. 212-1287-13

[28] Statistical Evaluation of GMAW Process Disturbances with ANALYSATOR HANNOVER
Dietrich Rehfeldt and Yonglun Song (Germany)
Doc. 212-1278-13

[29] Observation of Welding Phenomena in Two-electrode Welding of Plasma and MIG
S. Yamane, H. Numazawa, F. Kong, K. Hosoya, T. Nakajima and H. Yamamoto (Japan)
Doc. 212-1295-13

[30] Study for the Mechanism of TIG-MIG Hybrid Welding Process
S. Kanemaru, T. Sasaki, T. Sato, T. Era and M. Tanaka (Japan)
Doc. 212-1280-13

[31] Numerical Analysis of the Temperature Profiles in Laser-GMAW Hybrid Welding of Aluminium Alloy T-Joints
Wu C S, Xu G X, Qin G L, Wang X Y (China)
Doc. 212-1281-13

5. Recommendation of publication for IIW Journal “Welding in the World”

6. Miscellaneous

7. Date and place of next meeting

8. Closure of regular meeting of SG212

STUDY GROUP RES

Document SG-RES-0194-13
Agenda of Annual Meeting

Author: Américo Scotti

Notes:

Friday, 13th September, 2013
12:30 - 14:00
MESSE ESSEN Fair Venue - Germany

Annual Meeting of Study Group RES
13th September, 2013
MESSE ESSEN Fair Venue - Germany

AGENDA

1. Opening Remarks (12:30/12:40)
Chairman: Prof. Américo Scotti (Brazil)

2. Approval of the Minutes of the annual meeting held on July 2012 in Denver, USA (12:40/12:45) - (SG-RES-0192-12 – see Annex I)

3. Invited Presentation on Research Strategy and cooperation (12:45/13:15)
"Moving Welding from Science to Engineering" (see summary attached as Annex II)
Prof. Patricio Mendez (University of Alberta – Canada)

4. Invited Presentation on Research Strategy and cooperation (13:15/13:25)
"Sub Platform Joining"
Prof. Luisa Quintino (EWF)

5. Summary of the 2nd IIW European-South American School of Welding and Correlated Processes (13:25/13:30)
Prof. Dr. Norbert Enzinger (Graz University, Austria)

6. Oragnization of the 3rd IIW European-South American School of Welding and Correlated Processes (13:30/13:40)
Américo Scotti (Laprosolda, Brazil)

7. Change of the wide-ranging participant coverage of the event IIW School of Welding: new name and scope (III Research School of Welding and Correlated Processes) (13:40/13:45)
Américo Scotti (Laprosolda, Brazil)

8. Announcement of the 4th IIW Research School of Welding and Correlated Processes, 2014 (13:45/13:50)
Chris Smallbone (WTIA)

9. Proposal for the organization of the 5th IIW Research School of Welding and Correlated Processes, in 2015 (13:50/13:55)
Américo Scotti (Laprosolda, Brazil)

10. Closing Remarks (12:55/14:00)
Américo Scotti (Laprosolda, Brazil)

ANEX II

Document SG-RES-0192-12
Minute of Annual Meeting

Study Group RES
Annual Meeting in Denver
10th July 2012

Participants

Americo Scotti	Brazil
Chris Conrardy	U.S.A.
Chuansong Wu.....	China
David Yapp.....	United Kingdom
Dorin Dehelean.....	Romania
Jan Pilarczyk.....	Poland
John Norrish.....	Australia
Luísa Coutinho.....	Portugal
Norbert Enzinger	Austria
Paul Woollin.....	United Kingdom
Peter Klamo.....	Slovakia
Peter Norman.....	Sweden
Peter Polak.....	Slovakia
Rosa Miranda.....	Portugal
Slobodan Kralj.....	Croatia
Ulrich Dilthey.....	Germany
Zhou.....	Singapore
Norman Zhou.....	Canada

WY

Opening Remarks

1. L. Coutinho opened the meeting welcoming all present and thanking for their participation.

2. Election of Chairman

Américo Scotti, from Brazil, University of Uberlandia elected.
L. Coutinho briefly presented Prof. Scotti, thanking his initiative for starting the Research Welding Schools.

3. Approval of the Minutes of the annual meeting held on July 2011 in Chennai, India

Minutes were approved.

4. Presentations

Prof. Stephen Liu opened with a presentation "Research and Educational Activities on Welding Technology in U.S.A.", focusing on an overview of the world economic situation and

expectations and outlining the universities, laboratories and institutes involved in education and research in welding in USA.

Trends in welding research were presented based on collection of data on topics of published papers in three main welding journals (Science and Technology of welding and joining, Welding Journal, and Welding in the world) from U.S.A., in two periods 2000-2009 and 2008-2012.

Norbert Enzinger presented the 2nd European-South American School of Welding, to be held in Wells, Austria in September, hosted by Fronius, which aims at interchanging experiences in research in welding technology, discussing research strategies and methodologies. It will include presentation of on-going research works, round table discussions and a technical visit to a steel plant.
All participants were invited to participate.

Both presentations are appended to the minutes.

5. Trends Welding Research (all participants)

CANADA (Norman Zhou) - Waterloo University started activity in friction stir welding. On going areas of research include laser welding, brazing soldering, micro and nano joining. Funding has been good but problems are expected in the near future since Government is cutting the research funds.

PORTUGAL (Rosa Miranda) – no funding from Government for research centres, only industry research funding will be possible in the near future.
The number of students in engineering courses as Mechanical, Materials, Naval, is increasing.

AUSTRIA (Norbert Enzinger) – Funding for research in welding is limited and dependent on time consuming proposals for projects.The industry is strong and always in need of research in welding. Topics and funding vary significantly, dependent of managers of big companies which tend to change often. The number of students is increasing in university courses but not in PhDs. Electron beam welding is a new activity in Graz University as there is an industry need for this technology.

SWEDEN (Peter Norman) – a conference is being organised in the near future to debate research in welding, which will give an insight of the strategy in the country. As in other countries, the problem in getting funds for research was also referred.

BRAZIL (Américo Scotti) – research is based in universities, which depend mainly on Government funding, and manufacturing is not a government priority. Not many students apply for MSc and PhD programmes. An example of a priority area is Nanotechnology
ROMANIA (Dorin Dehelean) –Most research funds come from Government since industry is try not interested in supporting research. There are approximately 20 providers of RTD in welding in Romania.

USA (Chris Conrardy) reported that Government funding. is unstable, with 70% of funding coming from industry. The main target is the creation of large teams involving university and companies. Additive manufacturing is a hot topic.

UNITED KINGDOM (David Yapp, Paul Woollin) informed that the funding for university & industry groups is sustained in spite of recession. Oil, gas and aerospace are main areas of research where welding is an important technology. The number of students in MSc course in welding technology is stable. TWI has an internal research budget due is activity in EU Programmes, where there is an increasingly competition. The 8th Framework Programme will bring uncertainly to RTD funding. In UK there are several networks advertising innovative topics as additive manufacturing, NDT, FSW, coatings, nano metals (oil and gas industry).

SINGAPORE - Wei Zhou reminded that Singapore is nº 5 in the world in use of steel and nº 1 in construction of offshore structures. Though being a small country, an event on underwater welding has been organised recently but not many people from oil offshore participated. Government funds for research are available but very low funding is allocated for welding technology, while it is better for adjacent areas as laser applications, adaptive manufacturing, high strength steels, light alloys.

CHINA (Chuansong Wu) – funding is good in some areas as plastics, not as good for "welding". The Ministry for Science and Technology decides on the priority research areas – nanoscience, biology have been "hot topics" in the past 3 years. 3 or 4 big projects in welding and related technologies have also been funded. A Bachelor degree in welding has been created in 3 universities. Slobodan Kralj from CROATIA informed that no money for research neither from government or industry is available. Examples of on-going research projects are: H2 in high strength steels and corrosion in stainless steels welding.

AUSTRALIA (John Norrish) – Australia is the fast growing economy in the world with a strong dollar. There is a shortage of welding personnel, namely welders but research activities are in good progress. Australian government's attitude is to get agreements between industry and university and create collaborative research centre. Welding of high strength steels, and additive manufacturing are examples of topics addressed.
Wollongong and, Adelaide Universities are two major players in research in welding technology.

SLOVAKIA – Peter Klamo informed that the country economy is in quite good condition. The drivers are automotive companies due to the big automotive plants in the country, which need welding technology. Government support for research is decreasing, though structural funds from EU are a good source of funding.
Centres of Excellence have been established. VUZ is involved in one in welding. FSW of tubes and thick steels plates, physical simulation, laser applications, welding on pressure vessels by EB are examples of areas of research in this centre.
POLAND – Jan Pilarczik reported that manufacturing industry is relevant and growing in Poland thus welding experts are needed. There is a strong competition to apply for research grants and government is launching a new centre for research and development which will include welding technology. Ulrich Dilthey highlighted the German situation where funds for research are good. Cooperation industry/universities is good as well. Many companies reduced research capacities in the past due to the economic downturn. Now with German economy

picking up companies need research capacity, creating a growing demand. An initiative to grade "excellent" universities based on research projects, accredited schools, influences funding for future, development. 5 years ago 10 Universities reached this ranking and in 2012, though 3 of the 10 dropped, the total considered "excellent" increased to 14. These universities get good funding from government. There is a positive development in number of students. As an example, Aachen University had 4000 applications from which 2000 students entered. 423 was the lowest number of students' intake, in the past. The interest in engineering is high.

6. Closing Remarks

L. Coutinho informed about the Research platform "Manufacture" created in Europe which will influence the topics for research in the 8th Framework Programme. A project to launch a sub-platform in Joining Technology in being developed. Maichael Kubica, from Poland, showed and distributed poster and leaflets for the Universary of Instytut Spawalnictwa in October. L. Coutinho closed the meeting thanking all involved for their valuable contributions.

Annex II

"Moving Welding from Science to Engineering"

By: Prof. Patricio Mendez

Abstract: Until recently welding was little more than an art. Through the intense work of the welding research community welding is understood now as a science. The causes driving many observable effects are known and the community is confident the remaining unknowns are tractable. Conversely, this scientific understanding has had little uptake in industry, whether is equipment makers, consumable makers, or manufacturers of welded product. One of the reasons is that the gap between scientific understanding and practical application is too broad. This is understandable, since the scientific knowledge has not yet been generalized in the form of design rules or synthesized in the form of tables, formulas and reliable heuristics. A promising approach to synthesis and generalization being pursued at the Canadian Centre for Welding and Joining will be presented.

Prof Mendez is the Weldco/Industry Chair in Welding and Joining and Director of Canadian Centre for Welding and Joining at University of Alberta. Before joining the University of Alberta in January 2009, he taught and researched at the Colorado School of Mines. Before that, he was a consulting engineer at Exponent Inc. In 1995 Dr. Mendez co-founded Semi-Solid Technologies Inc. in Cambridge, MA. Prof. Mendez holds a Ph.D. and a M.S. degree in Materials Engineering MIT and a Mechanical Engineer degree from the University of Buenos Aires. Among his distinctions are the IIW Kenneth Easterling Award, the AWS William Spraragen Award, Charles H. Jennings Award, the Silver Quill Award and the NSF CAREER Award.