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Working Group FSW Processing

Minutes

No 1

from the constitutive meeting **March 7th 2007** at the Swedish Welding Commission in Stockholm.

Present:
Johnny Sundin, Esab, Sweden
Jukka Mononen, Helsinki University of Technology, Finland
Kati Savolainen, Helsinki University of Technology, Finland
Anna de Try, KIMAB, Sweden
Erik Tolf, KIMAB, Sweden
Therese Källgren, KTH, Sweden
Lars Liljeblad, Liljeblad International Consulting AB, Sweden
Leif Magne Kaalaas, MarinAluminium, Norway
Patrik Hertel, Sandvik Process Systems, Sweden
Lars Mohlkert, SAPA Technology, Sweden
Olga Mishina, SAPA Technology, Sweden
Pontus Davidsson, SAPA Profiles ,Sweden
Lars Cederqvist, SKB, Sweden
Mathias Lundin, Svetskommissionen, Sweden

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1. Opening of the meeting (10.00 h)

   Lars Mohlkert and Mathias Lundin whished everyone welcome to this initial and constitutive meeting at the Swedish Welding Commission, SWC. The agenda was approved.

2. Election of chairman and secretary for the meeting

   Lars Mohlkert was elected chairman. A length of term was not decided, hence for the time being.

   Mathias Lundin was appointed secretary.

3. Practical issues (language, departures etc)

   Following the highest percentage on the questionnaire and the consensus of the present participants it was decided to conduct all meetings and correspondence in English.

4. Presentation of each organisation and their activities

   A short summary of the presentations below, see also attached documents for some presentations.

   Mathias Lundin, Swedish Welding Commission

   SWC is a member organisation which organises industry collaboration and play an important roll for standardisation, education, the coordination of R&D efforts and spreading information. Mathias is responsible for standardisation, healt & safety, part of the educational scheme and some of the working units. See also **www.svets.se**.

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Patrik Hertel, Sandvik Process Systems, Sweden:

Joining of steel mostly for chemical industry. Interest in FSW is concerning quality rather than productivity. Also joining thin films, started with laser but are now moving to FSW. Sandvik is on the users side and are not developing the FSW process. Are focused on joining 0,8 – 3 mm stainless steel sheets.

Lars Liljeblad, Liljeblad International Consulting AB, Sweden:

Is a one man consulting firm representing the interests of MegaStir in the Nordic region. Developing tools for FSW of steel up to one inch sheet thickness, and also pipe up to 6 mm thick. Also heavily involved in FSSW with American and Japanese automotive industry. Have a technique which leave no hole. Have also made some preliminary tests in the US joining aluminium to steel. Don't have any production welding of steel yet. See also **attached slides (01).**

Jukka Mononen and Kati Savolainen, Helsinki University of Technology, Finland

Professor Hannu Hänninen is the head of the department where 10 technical staff and assistance and 18 researchers work. "Producing" some two PhD per year. Have equipment for FEG-SEM, X-ray diffraction, thermal fatigue testing, FSW etc. In welding focus is on joining dissimilar, FSW, TIG and SAW in narrow gap etc. Have had FSW projects at TKK since year 2000. Among others, 3 year EuroStir project joining Cu/Al. Ongoing is a 2 year project with Sandvik etc for joining stainless and dissimilar. See also **attached slides (02)**.

Anna de Try and Erik Tolf, KIMAB, Sweden:

Points out application rather than fundamental research. KIMAB have larger member programs of which one is "Fogningscentrum" that have and have had numerous FSW-projects. Erik showed some details on these projects. See **attached slides (03).**

Johnny Sundin, Esab, Sweden

Johnny showed a reference list with 37 machines installed/delivered. All in aluminium applications. There is a definite market increase. Some discussion on welding with bobbin tool from both sides. See also **attached slides (04)**.

Therese Källgren, KTH, Sweden:

Professor Rolf Sandström head of department. 4 researchers in joining. 3 main projects with FSW of copper. Therese main project is for SKB and the nuclear fuel canisters in copper. Are doing temperature distribution modelling, creep testing to extrapolate the material response for 100 000 years etc.

Pontus Davidsson, SAPA Profiles , Sweden

Pontus is working with manufacturing of panels mainly for the ship yards industry and he is responsible Welding Coordinator.

Leif Magne Kaalaas, MarinAluminium, Norway

The yard is located in Haugesund and the main focus is overhaul of semi-submerged oilrigs and North Sea applications. From 2005 MarinAluminium is an independent company due to management buyout. Leif is manager for all FSW. Typical products are off-shore modules, telescopic bridges (30 bridges delivered), "flexibarrier" for safety, conventional railing system, helicopter decks (booming market), accommodation ladders, panels for trucks, "Mega panels", "Multi stiffened panels", panels for catamaran superstructure etc. First commercial FSW-machine installed in 1996. Are producing 100.000 meter FSW per year. See also **attached slides (05).**

Lars Cederqvist, SKB, Sweden

Developing technique for welding for nuclear waist canisters in copper alloy. Have looked at EBW since 1982 and FSW since 1997. Have made 58 lid welds (inkl more than 200 weld cycles) since april 2003. Current analyses are corrosion, creep, residual stress. A current project is also an acceptance program for the application to the Swedish authority. Future work would be to elimi-

nating the human factor, developing software that can monitor the process on line for adaptive thermal management, and also increase the process window for tool temperature (surface treatment for the tool probe etc). Maximum thickness study 6-7 cm copper. Repair capability. See also **attached slides (06).**

Lars Mohlkert and Olga Mishina, SAPA Technology, Sweden

Lars made a presentation of SAPA that is owned by Orkla, Norway. 50 people working with FSW in Finspång. Merger with Alcoa is on the way.

First FSW weld at SAPA in 1994. Are producing 1000 to 1500 meter FSW per day. Mainly welding panels from profiles welded from both sides with channels with built in support, "double sided welding in hollow profiles". Also sealing lids for electronic coolers. Methods approved by the railway authorities and the "klassningssälskap". About the future Lars mentioned higher welding speeds, Spot welding, Robotic welding and Standardisation.

Olga is working with finding appropriate joint and tool design etc. Main work is development.

See also **attached slides (07).**

The chairman thanked everyone for their input and concluded that there is a broad experience gathered in this group from which future collaboration should be able to prosper.

5. Short report on FSW standardisation activities in IIW (ISO/DIS 25239-1 to -5)

   The chair is a member of the standardisation group in IIW, Com III SC III-B WG 1. IIW has an agreement with ISO to develop ISO-standards which they do in some areas coordinated with the work in ISO/TC 44 "Welding and allied processes".

   The status for ISO/DIS 25239 is that a DIS-vote (six months voting period) is expected within some 2-3 months. This group should be able to process comments to the draft before voting (see next meeting below). As members of IIW the Swedish Welding Commission can circulate IIW-documents to its members. See **attached drafts (08)**.

   Lars mentioned that he has not been successful in adding other materials (than aluminium) to the scope. Also, the draft only covers but welds since there have been difficulties in agreeing on qualification of lap welds.

   It was noted that Mazda have a corporate standard for FSSW (spot welding).

6. Follow-up on the Questionnaire

   A revised version of the compilation of answers was handed out, **attached (09)**. Mathias addressed some details, however, the discussion turned to a working program (item 7).

7. Drafting of a Working Program

   The meetings should be combined with a presentation of a site (technical visit). Also one or two in depth reports during a seminar part, and a part with short reports. A conference schedule on the web site was considered useful. The subject of patents should be addressed.

   Discussion on license issues: License cost about 30 000 EUR/year for production within one company site. One can also by a machine license, one time cost for one machine. You can also by a license for research. Industrial members of TWI get discount on the license fee. License and patents issues are prohibiting the spread of the technique. Lars C suggested that people outside the FSW community could participate for a meeting to present an application which FSW could be applied.

   One topic for the WG could be making of a database for test result.

   Olga forwarded the idea to advertise in the journals about the existence of the group to invite more members and also to propose the group to answer questions concerning FSW.

Mathias Lundin had drafted a working program which was discussed and amended. It was decided that Mathias revises the draft further and attach it to the minutes for comments and possible acceptance at the next meeting. See **attached draft (10)**.

8. Form for administration of the group

   The chairman pointed out that an administrative capacity is needed. He considered the use of SWC as a convenient solution which he proposed.

   Mathias explained that SWC is willing to provide the service. For the survival, SWC needs the participants to be members. The fee is 9.700 SEK/share (one share only for non-Swedish members). However, this is not an immediate request and non-members are welcome as the group gets established.

   The use of the website (svets.se) as a platform for communication within the working group and to the industry is available.

   It was decided that the invited experts would consider the proposal for further decision at the next meeting.

   Further, it was decided to ask the other Nordic welding societies about their interest to participate and also to write a press release on the forming of the work group.

9. Member issues

   A list of experts that have expressed their intent to participate is **attached (11)**. Suggestions for other members of the working group (anyone missing?) can be forwarded to Mathias Lundin.

10. Arrangement for subsequent meeting

    Next meeting was decided for the **1-2 October 2007 at SKB in Oskarshamn**, Sweden after an invitation by Lars Cederquist. Suggested program, see also outlined in Lars attached slides **(06)**:

    Day 1 (1 October) – Field trip(s)

    14:00-16:00 @ Clab – Central interim storage facility for spent nuclear fuel

    16:15-18:15 @ Äspö Hard Rock Laboratory – an underground laboratory

    Day 2 (2 October) – FSW meeting

    9:30-15:45 @ Canister Laboratory

    Preliminary agenda items:

    - NDT reliability study at SKB incl. ultrasonic & X-ray testing equipment
    - Quality assessment at SAPA
    - Quality of FSW in steel at Sandvik Process Systems
    - Live-FSW of lid to 5 cm thick copper canister & Canister Lab.-tour

    Note that this is a preliminary schedule. It is possible to connect at Äspö (Day 1). See www.skb.se for facility-information and www.skyways.se for flights from Arlanda

    Proposed main theme is "NDT and imperfections" with presentations from Lars Cederquist and Lars Mohlkert (more presentations on this and others subjects are requested).

    "Please do not hesitate to announce your possible presentations or hosting of coming meetings."

11. Closure of the meeting

    The chairman thanked everyone for their attendance and contribution, and closed the meeting.

Meeting secretary

Mathias Lundin