

Minutes of the IAPWS working group IRS, Prague, 2. – 7. September 2018

(Numbering of topics follows TPWS agenda, except where denoted "...-IRS")

1. The Chair, Nobuo Okita, opened the IRS joint at 11:15 am, 2. September 2018. Agenda was adopted without changes.
2. Appointed Adam Nový as a clerk of minutes
3. No potential collaborative projects reported
4. Industrial Requirements and Solutions for Steam Property Calculations [joint with WG TPWS]

4.1 Report of the Task Group "Categories of industrial requirements" (N. Okita, A. Nový, I. Weber, A. Anderko, M. Rziha, R. Span)

N. Okita reported the status of the TG as new members have joined the TG: A. Anderko (PCAS), M. Rziha (PCC) and R. Span (TPWS incl. SCSW). The presentation was done twice, once in the joint meeting with TPWS and then later afternoon joint with PCC and PCAS. N. Okita summarized the purpose, WG history and schedule of the task. It was presented the list of the possible interests which is ready to be circulated within the all IAPWS members. There were also examples from industry mentioned for better understanding. The categories are gathered and sorted in three ways: First the list of the items, second items in the hierarchical tree and the last form is the list grouped by the expected IAPWS output. In the separate IRS meeting it has been decided to keep the TG running on maintaining the list and incorporate the TPWS/SCSW, PCAS and PCC inputs.

The following discussion (summarized from IRS, TPWS and PCC/PCAS groups):

B. Dooley has noted that there is missing surface tension, T. Rziha mentioned the importance of film forming substances where is a lack of knowledge and also the high practical interest of the acid dew point. The conclusion of the separate IRS discussion was, that among IRS are unable judge which categories/topics are important so the help from other IAPWS members is necessary. It was also decided to continue maintaining the categories lists and incorporate new information into the shared document.

TODO:

Distribute the categories to all IAPWS members and do the process of evaluating the distance to the IAPWS business. Proposed to share the categories document using the OPAL password protected site. Try to evaluate the importance of the categories regarding steam turbines and combined cycle with GT at first.

The progress will be reported at the next annual meeting.

4.2 Report of the Task Group "Industrial Advisory Note" (M. Hiegemann, B. Rukes, A. Singh, A. Harvey) (presented by N. Okita)

The report was given by N. Okita as M. Hiegemann is not active for now. There was proposed to terminate the TG and consider reopening after the categories are being prepared. This was unanimously accepted.

4.3 Report of the Task Group "Wet steam properties Calculation" (A. Nový, J. Hrubý, K. Orlov, R. Span, K. Meier)

A. Nový reported preparation of three calculation models for the speed of sound in wet steam to be tested on measured data from last stages of nuclear power plant turbine by the end of 2018.

K. Mayer did some literature research and presented model from literature for calculating two phase flow speed of sound. It was mentioned, that the speed of sound depends on many parameters, for example the flow type and the flow speed.

The following discussion:

D. Friend mentioned the possible effect of the frequency of the soundwave to the speed of propagation. J. Hruby mentioned the work of Prof. Petr regarding the dispersion where for very high speed of flow the speed of sound was "frozen" and for low flow speed was "equilibrium". So more speeds of sound exists dependently on the flow speed. S. Senoo proposed also focus on measurement techniques.

TODO:

Continue the review of literature and test the calculation models on available measured data.

4.4 Report of the Task Group "Wet Steam Data from Operating Turbines" (N. Okita, A. Nový, I. Weber, S. Senoo)

N. Okita explained the purpose and plan. There was also cleared, stated, what data are being needed. The plan was to gather data, share it and finally make some output.

The following discussion:

A. Nový shared the result of internal company survey, that there is not possible to directly share the data because of legal issues and protection of know-how, but there is a possibility to test calculation models on the data within the company.

The following discussion:

Further discussion within the IRS led to the clearing out the purpose of the data being gathered. First is the problem of wetness losses and second, the erosion problem. For these purposes the simulation model and measurement technique are needed.

TODO: N. Okita will contact D. Friend for ASME or any other specialists for possible assistance with measurement of the droplets spectrum and velocity distribution. TPWS members should be contacted for reviewing existing calculation models of droplets forming. Investigate the possible form to be opened of sharing the data, try also to ask ASME for possible assistance in parallel.

5. Minor Revisions to IAPWS Documents [joint with WG TPWS]

5.1 Report on minor revision of IAPWS-95 Release (A. Harvey)

5.2 Report on evaluation of IAPWS-95 revision (K. Miyagawa, presented by A. Harvey)

5.3 Formal consideration of IAPWS-95 Revised Release

5.4 Report on minor revision of Advisory Note 3 on Thermodynamic Derivatives from IAPWS Formulations (H.-J. Kretzschmar)

5.5 Report on evaluation of Revised Advisory Note 3 (K. Meier)

5.6 Formal consideration of Revised Advisory Note 3

Items Covered by TPWS minutes

6-IRS/PCC/PCAS. Report of the Task Group “Categories of industrial requirements” (N. Okita, A. Nový, I. Weber)

Covered by point 4.1

6. Heavy Water Properties [joint with WG TPWS]

6.1 Report of Task Group on Heavy Water Thermodynamic Properties (R. Span, A. Harvey, S. HERRIG)

6.2 Report of Evaluation Task Group for Heavy Water Formulation (H. -J. Kretzschmar)

6.3 Formal consideration of Revised Release for Heavy Water

6.4 Report of TG for Heavy Water Transport Properties (J. Sengers, M. Asseal, M. Huber, R. Perkins, presented by A. Harvey)

Items Covered by TPWS minutes

7. Report of Task Group on Surface Tension of Ordinary Water [joint with WG TPWS and SC SW]

(J. Kalová, V. Vinš, A. Harvey, O. Hellmuth, V. Holten, J. Hrubý, , R. Mareš, J. Pátek, F. Caupin)

Covered by TPWS minutes

8-IRS. Discussion on “Wet Steam Data from Operating Turbines”

Covered by point 4.4

11. IAPWS Certified Research Needs (ICRNs) [joint with WG TPWS]

11.1 ICRN 27: Thermophysical Properties of Humid Gases and CO₂-Rich Mixtures (closing statement needed) (R. Span, A. Harvey)

Covered by TPWS minutes

11.2 Report of Task Group on ICRN for acid gas dew points (N. Okita, K. Orlov, R. Span)

N. Okita presented the upgrade of the last year regarding dew point under low sulfur content related to HRSG for GTCC. Suggestion to IAPWS is to unify method for predicting dew point under low sulfur contents by theoretical approach using models and post/revise ICRN 23. Equilibrium calculation and modification of Otsuka equation and fitting recent data were tried to improve, but in vain due to lack of data for low sulfur.

Following discussion:

A question is raised by J. Hrubý whether kinetic or thermodynamic approach is necessary. It is beyond the knowledge at the moment. A. Harvey suggested cooperation with PCAS

12. IRS Discussion on “Categories of industrial requirements”

Covered by point 4.1

13-IRS Other Business: No other business.

14-IRS Membership: No changes in membership.

15-IRS Contribution to Press release will be done by the WG chair

16-IRS Formal motion to the EC will be prepared by the WG chair

17-IRS meeting was adjourned 2. September 2018, about 17:15.