

Minutes of the IAPWS working group IRS, Kyoto, 28. – 31. August 2017

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

1. Nobuo Okita opened the session for IRS at about 10:30 am, 28. August 2017. The agenda was adopted without changes.
2. Adam Nový was appointed clerk of minutes.
3. Covered in TPWS minutes.
4. Covered in TPWS minutes.
5. Industrial Requirements and Solutions for Steam Property Calculations [joint with TPWS]

5.1 Report of the Task Group "Categories of industrial requirements" (N. Okita, A. Nový, I. Weber)

N. Okita explained the purpose of the T.G. and presented the gathered and sorted topics of the potential areas of interest of IRS group. The items were sorted from different point of views and supported by examples. There was discussion following the presentation. D. Friend asked about the form to be circulated within IAPWS members, what will be the final form, set of ICRNs or document available on the webpages? N. Okita answered that the final form is not known yet as it is the initial kickoff and is about to be considered.

TODO:

- 1) Categorize items in terms of expected IAPWS output (ICRNs, Guidelines, Standards, etc.) and discuss the distance to IAPWS business.
- 2) Make the categories available in comprehensive to all IAPWS members to comment.

5.2 Report of the Task Group "Industrial Advisory Note" (M. Hiegemann, B. Rukes, A. Singh, A. Harvey)

M. Hiegegan was not present and no progress is known on this project. A. Harvey reminded the original purpose of the TG, to prepare a guideline for industrial application, which clarifies what IAPWS document should be used for in the industrial applications. The discussion concluded that it would be good to keep the task open

TODO:

- 1) Check the status from M. Hiegegan, and ask him, whether he will continue himself, otherwise find a new chair of the TG.

5.3 Report of the Task Group "Wet steam properties survey" (I. Weber, H. J. Kretzschmar, N. Okita, A. Nový)

There was presented survey by A. Nový summarizing the wet steam properties calculation used in some of Doosan Škoda in house IF-97 libraries and steam turbine calculation software. It was pointed out, that no standard and/or guideline exist for some of wet steam property calculation (speed of sound, viscosity, etc.). There was long discussion following, leading to setting up new T.G.: "Advisory Note on Wet Steam Properties Calculation" (A. Nový, J. Hrubý, K. Orlov, R. Span, K. Meier). The purpose will be to put together advisory note for industrial use, how to correctly calculate or estimate thermo-physical and transport properties of wet steam which are not part of the IAPWS-IF97 standard.

TODO:

- 1) Prepare list of the wet steam properties to be addressed.
- 2) Look up possible existing solutions (literature, models, measurements, etc.).

5.4 Acid dew point under low sulfur contents (N. Okita)

N. Okita presented the background, issues and status in Japan regarding the problems connected with dew point under low sulfur content related to HRSG for GTCC. It was pointed out, that the current knowledge does not include low Sulphur concentration areas and is solved in different ways within different companies. Suggestion to IAPWS is to unify method or data for predicting dew point under low sulfur contents and post/revise ICRN 23. Discussion will be followed by the “point of view” of Alstom and Siemens at the Thursday meeting for new ICRN.

TODO:

- 1) Decide next step, unify the methodic leading to guideline and/or revise the ICRN 23.
Discussed on item 17.2 (Covered in TPWS minutes)

5.5 Is it time for a new industrial formulation? (J. Bellows)

J. Bellows presented excellent overview of the IAPWS formulations prepared through the history and pointed out some important facts. There was every 30 years new formulation and bringing new formulation takes about 5 to 10 years. He also reminded the requirements for accuracy and speed and also so called long term stability. The main idea was, that it is “Time to start thinking”. The discussion was then started. After discussing the strong and weak parts of both existing formulations IAPWS-95 and IAPWS-IF97 (considering range, regions, calculation speed, applicability, TTSE, SBTL, etc.), it was concluded, that the best approach would be to revise the existing scientific formulation IAPWS-95 and the eventual “new industrial formulation” to be derived from the “new scientific formulation”. For this purpose the new T.G.: “New Scientific Formulation” has been set up (A. Harvey, J. Hrubý, N. Okita, K. Orlov, R. Span).

TODO:

- 1) Revise existing IAPWS-95 its weaknesses and potential upgrades, for example in range, data background, two-phase region etc. and also consider “mixture compatibility”, as advised by R. Span.

6 - 15. Covered in TPWS / SCSW minutes.

16-IRS. Discussion on the future of IRS

16.1 Nonequilibrium condensation model and numerical analysis for wet steam turbines (S. Senoo) [joint session with WG TPWS and PCAS]

Covered in TPWS minutes

16.2-IRS. Discussion on wet steam properties [IRS separate meeting with S. Senoo]

S. Senoo presented the details of specific requirements towards IAPWS regarding the wet steam in steam turbines modeling. 1) two-phase flow problem, especially focused on water film breakup model and droplets deposition model on the turbine blades. 2) Wetness measurement equipment and techniques. 3) Lack of measured wet steam data from operating power plants. The points 1) and 2) may be in future be addressed by formulating ICRNs or creating Guidelines or Technical guidance documents. For the point 3) new T.G.”Wet steam Data from Operating Turbines” has been set up (N. Okita, A. Nový, S. Senoo?, I. Weber?, A. Singh?, M. Hiegemann?). The task group should gather the steam turbine measured wet steam data and share it within the T.G. members.

TODO:

- 1) Ask I. Weber?, A. Singh?, M. Hiegegan? Whether they want to participate.
- 2) Prepare form of gathering and sharing.
- 3) Ask ASME for possible assistance.

16.3-IRS. Evaluation of distance to IAPWS business and stakes holders [IRS separate meeting]

Discussing the list of possible topics of IRS business as presented in point 5.1. The discussion led to conclusion, that within IRS we are unable to judge the items distance to IAPWS so the other W.G. will be asked for help. The T.G. “Categories of industrial requirements” about to be expanded with at least one representative of each IAPWS W.G., to properly judge the items distance to IAPWS business.

TODO:

- 1) Ask chairs of W.G.s for candidates to expand the T.G. “Categories of industrial requirements”

16.4-IRS Features and problems of the geothermal steam turbine cycle [IRS separate meeting with N. Yamaguchi]

N. Yamaguchi presented the details of specific requirements towards IAPWS regarding the geothermal power plants. There were five main areas of interest mentioned.

- 1) Steam – gas mixture thermo-physical properties
- 2) Wetness measurement
- 3) Steam scrubbing
- 4) Silica content measurement and affecting of silica scaling
- 5) Modeling two-phase flow for binary type power plant heat exchanger

The discussion concluded that topics 3) and 4) to be moved to PCC W.G. topic 5) to be treated individually outside IAPWS at this moment. The topic 1) is to be covered by future ICRN. Topic 2) was not addressed with specific solution and was left for future decision.

TODO:

Prepare draft of ICRN regarding point 1) Steam – gas mixture in geothermal power plant turbine thermo-physical properties within the Japanese committee possibly with support by New Zealand and reviewed by the geothermal session of ICPWS 2018 for common requirements.

17. IAPWS Certified Research Needs (ICRNs)

Covered in TPWS minutes.

18. Covered in TPWS / SCSW minutes.

19. Other business: No report for IRS

20. Membership

- 1) Michael Daur has retired. Replacing M. Daur, Olaf E. Lemp (Germany) was proposed as new IRS member.
- 2) Shigeki Senoo (Japan) was proposed as new IRS member by H. J. Kretschmar and seconded by N. Okita

IRS unanimously accepted both new members.

Other changes:

There were noticed changes in e-mail addresses of F. Blangetti, M. Heigemann and P. Murphy.

21. Contribution to Press release will be done by the WG chair

22. Formal motion to the EC will be prepared by the WG chair

23. The IRS meeting was adjourned 31. August 2017, about 12:10 pm.