Application for International Collaboration
Corrosion Product Sampling, Analysis and Assessment

Background

The IAPWS TGD on corrosion product sampling and analysis has already taken a leadership position for fossil and combined cycle plants worldwide. Not only does this TGD provide details on how and where to take samples and to analyze them properly to determine total iron and copper levels, but it also provides limits for iron and copper, which illustrate optimized cycle chemistry according the IAPWS treatment TGD for AVT, OT, PT and CT. These levels have become standards worldwide. However, it is recognized that for heavily flexibly operating plant (fast start, cycling and two-shifting) these limits may not provide a rugged assessment of the cycle chemistry or whether FAC is under control. Therefore, this Corrosion Product Sampling and Analysis TGD needs revision with new assessment methodology being developed. This first requires cooperation with a range of power plants applying a variety of chemistry conditions that already conduct or are willing to conduct the corrosion product monitoring campaigns with parallel measurements of both classical analysis (as defined by the IAPWS TGD) and on-line methods during flexible load conditions and start-ups. A number of organisations have already taken part, but they often lack resources and the right setup of monitors to cover the demands fully. IAPWS in NZ/AU, UK/Ireland, and Scandinavia have formulated an approach, which will use a young scientist supported by an IAPWS International Collaborative Project. The Young Scientist will work under the direction of three IAPWS Members (Karsten Thomsen, SIAPWS, David Addison, New Zealand, and Paul McCann, BIAPWS) and cooperate with host plants that will conduct the field tests. It is planned that the Young Scientist will spend two weeks at three host sites. This will involve organizing monitoring campaigns, securing proper sampling conditions, applying and testing on-line instrumentation, and overseeing that the data acquired and submitted have the best possible quality. Most the equipment to conduct the tests and the analyses will be provided by the host site. All the analysis will be conducted or quality assured by the young scientist under the direction of the IAPWS monitor in SIAPWS, which will involve spending at least two weeks at a SIAPWS laboratory.

Technical Aspects and Goals

This planned activity will keep IAPWS in the leadership position with regards to corrosion products monitoring and assessment. The ultimate goal of the activity is to develop an IAPWS Map for the Decay of Corrosion Product Levels for flexible plant. The field tests conducted to date have demonstrated that on-line measurements such as turbidity and particle number/distribution may be used to follow particle levels and transport during start-up and flexible operation. The close relation between particle size distribution (PSD) and corrosion product (CP) distribution has been demonstrated both from basic principles and experimentally. Both PSD and CP distribution follow the log-normal distribution, and this new insight leads to a change in data processing of CP data and the use of new characteristic parameters to describe the level and variability of the CPs. These findings need to be confirmed for a number of cases representing the different chemistry typically applied in different plants. The ultimate goal is to establish a TGD covering sampling, analysis, and assessment of CPs for plants operating in flexible mode. This includes establishing an IAPWS Map for guiding values for levels, transport, and decay after startup. Of course, such values must be based on reliable and comparable data. Getting those within a reasonable period is the focus of this project. There is a great demand for such guidance worldwide, because power plant operating in flexible mode are numerous and the guidance so far has focused on plants in base load. The IAPWS Map will allow plants to determine whether both the operating and shutdown chemistry is optimized. For combined cycle plants, it will also link very closely with the IAPWS Map for HRSG HP Evaporator deposits (IAPWS TGD). The scientific content of the project will lead to a handful of

publications describing the connection between the fundamental PSD and the levels and distribution of CPs actually measured, the application of on-line methods as valuable tools to optimize the layup and shutdown chemistry, and the new data model leading to a change in routine data processing of CP data. In many senses, new territory is discovered in this study.

Young Scientist

SIAPWS has contact to a student at the Chemistry Department of Aarhus University who is interested in this project. He will be able to conduct the project for the master thesis. He is a very promising person who has A grades in almost every course so far. He is currently taking a semester at Stavanger University in Norway, focused on water chemistry courses, showing that he able to adapt and cooperate under foreign conditions.

Budget

Expenses to be covered:

1. Travel Scandinavia to UK, EI, FI x 1 each
2. Travel to NZ/AU x 1
3. Travel to IAPWS meeting x 1
4. Living expenses during stays

Additional analyses – the purpose is to supplement the analyses performed by/at the plants, such that all relevant measures are available for the evaluation in relation to the TGD development work. Quality of the data will be a focus point, and only laboratories that are able to document appropriate quality assurance at least at the level of the current TGD will be used.
Total budget is estimated at 20.000 GBP. The budget will be further refined, once the precise extent of the field trials is known.
On behalf of IAPWS organizations in Australia, New Zealand, United Kingdom and Ireland, and Scandinavia
Karsten Thomsen
SIAPWS Chair, member of PCC and the TGD task group