Argentina and Brazil Bi-National Committee
(Associate Member)

International Association for the Properties of Water and Steam

REPORT on IAPWS related activities - June 2016

Institutions participating in the research of thermo-physical properties and chemical processes:

- Comisión Nacional de Energía Atómica, Argentina
- Energetic and Nuclear Research Institute (IPEN) of the Brazilian Nuclear Energy Commission (CNEN)

Activities of Argentina Group:

A. At INQUIMAE (University of Buenos Aires) and the Department of Physics of Condensed Matter (CNEA), Dr. Corti's group is working on:
- Properties of the ice-vacuum interphase under supercooled conditions, using theoretical and experimental (AFM) techniques (in collaboration with Dr. Igal Szleifer group at Northwestern University).
- Transport and thermodynamics properties of aqueous ionic and non-ionics solutions in nano and mesoporous materials (silica and carbon).
- Development and characterization of materials (catalysts and membranes) for electrolytic splitting of hydrogen.
- Phase transitions in LiCl supercooled aqueous solutions induced by high pressure (in collaboration with Dr. Thomas Loerting group at Innsbruck University)

Activities of Brazilian Group:

A. Development of a Package to implement IAPWS-95 in "R"

The objective of this project is to develop and implement a new "R" package to supply water and steam properties, allowing easier analysis of experimental data for scientists and engineers that work with thermal and hydraulic water experiments and make use of "R".

"R" is a language and environment for statistical computing and graphics developed by "The R Foundation for Statistical Computing", from where we took the main information presented below (https://www.r-project.org/foundation/).

Project Tasks

1. Programming and compilation of a dynamic link library for the IAPWS-95 properties;

2. Development of the "R" Package called "waterPropertiesIAPWS95";

3. Implementation of this package at CRAN (*The Comprehensive R Archive Network*)

The activities of this project had being started by the Brazilian representative. The first task is almost complete and more than 80 functions for properties calculation based on IAPWS-95 are already working and tested in the "R" environment. New collaborators will be included in the project as it proceeds.

B. Starting activities to motivate Eletronuclear to give support to the Brazilian activities

Eletrobras Eletronuclear is a Brazilian company supplying electricity from nuclear energy. It is the Brazilian Nuclear Power Plants operator which controls two PWR Plants (Angra I and Angra II) and is the responsible for the construction of the third Nuclear Power Plant at Brazil, Angra III.

Dr. Leonam dos Santos Guimaraes from Eletronuclear will share the Brazilian representation with Prof. Dr. Benedito Dias Baptista Filho. With this new participation we may be able to held a future meeting of IAPWS at the City of Rio de Janeiro. He is an Executive Assistant to Eletronuclear CEO and Technical and Commercial Director of Amazonia Azul Tecnologias de Defesa S.A. (AMAZUL). He has a Doctoral Degree in Ocean Engineering on Naval Nuclear Propulsion and has around 30 years of experience in research, development, engineering, procurement and construction of naval and nuclear systems.

In a near future we will try to indicate a possible participant in the "Power Cycle Chemistry" area.

C. Study of Ionizing Radiation Effects on Nanofluids properties

A new research has just being started at IPEN with the main purpose of investigating the behavior of the thermal physical properties of nano-fluids during and after high doses of ionizing radiation influence. The fluid under investigation is light water with nano particles of Al2O3, TiO2, BeO, ZrO2.

Publications of Argentina Group:

- Pressure-induced transformations in aqueous LiCl solutions at 77 K. G. N. Ruiz, L. E. Bove, H. R. Corti, T. Loerting. Phys Chem. Chem. Phys. 16, 18553-18562 (2014).
- Diffusion-viscosity decoupling in supercooled glycerol aqueous solutions. J. A. Trejo González, M. P. Longinotti, H. R. Corti. J. Phys. Chem. B, 119, 257–262 (2015).
- Kinetics of the hydrogen evolution on nickel in alkaline solution by rotating disk electrode. E. A. Franceschini, G. I. Lacconi, H. R. Corti. Electrochim. Acta, 159, 210-218 (2015).
- Quasi liquid layer and surface melting of ice in contact with and AFM tip by molecular dynamics simulation. J. Gelman-Constantín, M. A. Carignano, H. R. Corti, I. Szleifer. J. Phys. Chem. C, 119, 27118–27124 (2015).
- Ni activation for H2 evolution reaction by spontaneous Ru deposition: a rotating disk electrode and impedance spectroscopy approach. E. A. Franceschini, G. I. Lacconi, H. R. Corti. Int. J. Hydrogen Energy, 41, 3326-3338 (2016).

- KOH-doped ABPBI membrane for alkaline water electrolysis: characterization and performance. L. A. Diaz, J. Hnát, N. Heredia, M. M. Bruno, F. A. Viva, M. Paidar, H. R. Corti, K. Bouzek, G. C. Abuin. J. Power Sources, 312, 128-136 (2016).

- Proton conductivity and water uptake of acid-doped ABPBI membranes prepared by low-temperature casting. L. A. Diaz, G. C Abuin, H. R. Corti. J. Electrochem. Soc., 163, F485-F491 (2016).

- The glass transition temperature of saccharide aqueous solutions estimated with the free volume / percolation model. J. Gelman Constantin, M. Schneider, H. R. Corti. J. Phys. Chem. B, en prensa.