Calculation of Water Vapor Pressure and Relative Humidity

p_{wv} (MPa) = water vapor pressure at temperature T
T (K) = temperature
All Temperatures in degree Kelvin (K) = °C +273.15

$$\vartheta = \frac{T}{T^*} + \frac{n_9}{\left(T/T^*\right) - n_{10}} \qquad \textbf{[1]}$$

with p^* = 1 MPa and T^* = 1 K.

$$\frac{p_{wv}}{p^*} = \left[\frac{2C}{-B + \left(B^2 - 4AC\right)^{1/2}}\right]^4 \qquad \textbf{[2]}$$

with p^* = 1 MPa and

$$A = \vartheta^2 + n_1\vartheta + n_2$$

$$B = n_3\vartheta^2 + n_4\vartheta + n_5 \qquad \textbf{[3]}$$

$$C = n_6\vartheta^2 + n_7\vartheta + n_8$$

Coefficients for Equations [1] and [3] are:

i	n_i	i	n_i
1	1.16 705 214 527 67 E+03	6	1.49 151 086 135 30 E+01
2	-7.24 213 167 032 06 E+05	7	-4.82 326 573 615 91 E+03
3	-1.70 738 469 400 92 E+01	8	4.05 113 405 420 57 E+05
4	1.20 208 247 024 70 E+04	9	-2.38 555 575 678 49 E-01
5	-3.23 255 503 223 33 E+06	10	6.50 175 348 447 98 E+02

To determine relative humidity (*RH*),

1. Calculate p_{wv} for humidifier temperature, $p_{wv,humidifer}$
2. Calculate p_{wv} for the cell temperature, $p_{wv,cell}$
3. $RH = p_{wv,humidifer} / p_{wv,cell}$ x 100%

This is done for the anode and cathode separately.

Source: "Release on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam," The International Association for the Properties of Water and Steam, Erlangen, Germany, September 1997

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