

Errata: Formulation of High Temperature Properties for Moist Air *

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It was recently brought to our attention that there are some errors in our paper, see Nelson and Sauer (2002). The results in the paper are correct, because we had the correct equations in the computer code. The corrections are:

(1) Equation (8) for C_{www} has a sign error prior to the T^2 term. The correct equation for C_{www} is

$$C_{www} = -10^6 \exp[-6.566276606 + 0.3894679516T - 0.0034281020537T^2 + 1.333924918 \times 10^{-5}T^3 - 2.726404078 \times 10^{-8}T^4 + 2.839369136 \times 10^{-11}T^5 - 1.189114330 \times 10^{-14}T^6]$$

(2) Equation (21) for $\bar{h}_{ig,a}^\circ$ is missing the denominators for each term. It should be:

$$\bar{h}_{ig,a}^\circ = 28.921316(T - T_o) + 2.5861872 \times 10^{-3}(T^2 - T_o^2)/2 - 1.9010204 \times 10^{-5}(T^3 - T_o^3)/3 + 5.1208717 \times 10^{-8}(T^4 - T_o^4)/4 - 3.2775941 \times 10^{-11}(T^5 - T_o^5)/5 + 8.0457$$

(3) In Eqs. (26) and (27) for the entropy of water vapor and air, respectively, the T_s should be changed to T . The error occurs twice in each equation.

(4) Equation (31) for the enhancement factor, f , has errors in the 1st, 5th, 7th and last terms. It should be:

$$\begin{aligned} \ln f = & \left[\frac{(1 + \kappa P_{ws})(P - P_{ws}) - \kappa(p^2 - P_{ws}^2)/2}{\bar{R}T} \right] \bar{v}_c + \ln(1 - \beta_{HXas}P) + \left[\frac{x_{as}^2 P}{\bar{R}T} \right] B_{aa} - \left[\frac{2x_{as}^2 P}{\bar{R}T} \right] B_{aw} \\ & - \left[\frac{(P - P_{ws} - x_{as}^2 P)}{\bar{R}T} \right] B_{ww} + \left[\frac{x_{as}^3 P^2}{(\bar{R}T)^2} \right] C_{aaa} + \left[\frac{3x_{as}^2(1 - 2x_{as})P^2}{2(\bar{R}T)^2} \right] C_{aaaw} \\ & - \left[\frac{3x_{as}^2(1 - x_{as})P^2}{(\bar{R}T)^2} \right] C_{aaww} - \left[\frac{(1 + 2x_{as})(1 - x_{as})^2 P^2 - P_{ws}^2}{2(\bar{R}T)^2} \right] C_{www} \\ & - \left[\frac{x_{as}^2(1 - 3x_{as})(1 - x_{as})P^2}{(\bar{R}T)^2} \right] B_{aa}B_{ww} - \left[\frac{2x_{as}^3(2 - 3x_{as})P^2}{(\bar{R}T)^2} \right] B_{aa}B_{aw} \\ & + \left[\frac{6x_{as}^2(1 - x_{as})^2 P^2}{(\bar{R}T)^2} \right] B_{ww}B_{aw} - \left[\frac{3x_{as}^4 P^2}{2(\bar{R}T)^2} \right] B_{aa}^2 - \left[\frac{2x_{as}^2(1 - x_{as})(1 - 3x_{as})P^2}{(\bar{R}T)^2} \right] B_{aw}^2 \\ & - \left[\frac{P_{ws}^2 - (1 + 3x_{as})(1 - x_{as})^3 P^2}{2(\bar{R}T)^2} \right] B_{ww}^2 \end{aligned}$$

(5) Equations (32), (33), and (34) for κ are in error. The equation for κ for pressures less than 1 MPa is

$$\kappa = 0.001 \left[\frac{7.120189263 \times 10^{-4} + 5.200072758 \times 10^{-6}t}{1 + 0.01093290154t - 0.00003305044473t^2} \right]^2$$

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where $t \leq 179.9^\circ\text{C}$ (453 K), the saturation temperature at $P = 1$ MPa. For $P = 2$ MPa and $t \leq 212.4^\circ\text{C}$ (485 K), κ is

$$\kappa = 0.001 \left[\frac{7.102925195 \times 10^{-4} + 4.766226644 \times 10^{-6}t}{1 + 0.01017519100t - 0.00003155751629t^2} \right]^2$$

For $P = 5$ MPa and $t \leq 263.9^\circ\text{C}$ (537 K), κ is

$$\kappa = 0.001 \left[\frac{7.029315292 \times 10^{-4} + 3.326752500 \times 10^{-6}t}{1 + 0.00746326448t - 0.00002544000334t^2} \right]^2$$

(6) Equations (36) and (37) for Henry's constant are in error. They should be:

$$\beta_{O_2} = \exp[-19.786773 + 23.393048X - 9.8984983X^2 + 2.2363172X^3 - 0.29618434X^4 + 0.017084932X^5]$$

$$\begin{aligned} \beta_{N_2} = & -288743.088 + 111167.594X + 491323.518/X - 27988.2964X^2 - 529382.752/X^2 + 4444.44530X^3 \\ & + 328398.259/X^3 - 404.940980X^4 - 89505.6879/X^4 + 16.1931127X^5 \end{aligned}$$

where $X = 1000/T$.

(7) In Figure 3 the values of specific entropy on the upper left-hand corner of the graph should be 2950 and 2700, not 950 and 700.

References

Nelson, H. F. and H. J. Sauer, Jr.. 2002. Formulation of High Temperature Properties for Moist Air. *HVAC&R Research* 8,(3):311-334.