LSNReviews

From: Osvaldo Pensado [opensado@swri.edu]
Sent: Friday, September 28, 2007 11:29 AM
To: 'Oleg Povetko'
Subject: Vapor pressure
Attachments: Page7-14.jpg; Page7-15.JPG

```
c=====================================================================
      function pvap( t )
c=====================================================================
c     NAME:     pvap
c
c     PURPOSE:
c           vapor pressure of water as a function of temperature
c
c     METHOD:
c           equation from R.C. Reid, J.M. Prausnitz, B.E. Poling,
c           "The Properties of Gases and Liquids, Fourth Edition,
c           McGraw-Hill, Appendix A
c
c     INPUT:
c           t    = double precision, temperature in units of [C]
c
c     OUTPUT:
c           pvap = double precision, vapor pressure of water in
c                  units of [Pa] which also is [N/m^2]
ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
c
      implicit double precision (a-h,o-z)
      data vpa, vpb, vpc, vpd / -7.76451, 1.45838, -2.77580, -1.23303 /

c     Constrain x to not go negative thereby limiting the temperature
c     for which the vapor pressure is calculated
      x  = 1.0 - (t+273.0)/647.3
      if(x.lt.0.0) then
        x = 0.0
      endif

      pvap = 221.2E+5 *exp( (vpa * x +vpb * x**(1.5)  + vpc * x**3 +vpd * x**6 )/ (1 - x))

      return
      end
```


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Properties Page

Return-path: <opensado@cnwra.swri.edu>
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 by rogain.cnwra.swri.edu (Sun ONE Messaging Server 6.0 (built Oct 29 2003))
 with ESMTP id <0JP300K314CSHN10@rogain.cnwra.swri.edu> for
 opovetko@cnwra.swri.edu; Fri, 28 Sep 2007 10:29:16 -0500 (CDT)
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 (virus89-out.ccf.swri.edu [129.162.252.34])
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 Fri, 28 Sep 2007 10:29:08 -0500 (CDT)
Date: Fri, 28 Sep 2007 10:29:07 -0500
From: Osvaldo Pensado <opensado@swri.edu>
Subject: Vapor pressure
To: 'Oleg Povetko' <oleg.povetko@swri.org>
Reply-to: opensado@swri.edu
Message-id: <031701c801e4$4f8fe220$d4c8a281@cnwra.swri.edu>
Organization: CNWRA
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7.3.1.3 Relative Humidity

The approach for calculating the relative humidity is described in Mohanty, et al. (2004). The relative humidity at the waste package is calculated based on the temperature on the waste-package surface and temperature at the drift wall. The partial pressure of water vapor in the drift is uniform, is the same as that at the drift wall at any location, and is used to calculate the relative humidity. The relative humidity at the waste package is defined as the ratio of the actual vapor pressure to the vapor pressure at the waste package surface

$$RH = \frac{P_V\left[min\left(T_b, T_w\right)\right]}{P_V\left(T_{wp}\right)} \tag{7-6}$$

where

RH	—	relative humidity [unitless]
P_v	—	vapor pressure calculated as a function of temperature [Pa]
$min\ (T_b, T_w)$	—	minimum of T_b and T_w [K]
T_b	—	boiling point temperature of water as specified by the *tpa.inp* parameter BoilingPointofWater[C]
T_w	—	drift wall temperature [K]
T_{wp}	—	waste package surface temperature [K]

The vapor pressure is calculated as a function of temperature based on the relation (Reid, et al., 1987)

$$ln\left(\frac{P_v}{P_c}\right) = \left[\upsilon_{pa}\left(1-\frac{T}{T_c}\right) + \upsilon_{pb}\left(1-\frac{T}{T_c}\right)^{1.5} + \upsilon_{pc}\left(1-\frac{T}{T_c}\right)^{3} + \upsilon_{pd}\left(1-\frac{T}{T_c}\right)^{6}\right]\left[\frac{T}{T_c}\right]^{-1} \quad (7\text{-}7)$$

where

ν_{pa}, ν_{pb}, ν_{pc}, *and* ν_{pd}	—	reference values or coefficients (Reid, et al., 1987)
T_c	—	critical Temperature {assumed 647 K [705 °F]}
P_c	—	critical Pressure {assumed 221 atm [3,247 psi]}