Excel Calculations

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Calculate Viscosity of Natural Gas with Excel

This Excel spreadsheet will calculate the viscosity of natural gas. The spreadsheet uses the Lee, Gonzalez and Eakin correlation for the viscosity, and the CNGA (California Natural Gas Association) correlation for the compressibility factor.

The Lee, Gonzalez and Eakin correlation, only requires the pressure, temperature and molecular weight of the natural gas, and is relatively accurate compared to more complex methods of predicting viscosity. It still widely used and accepted.

Parameters	
Pressure (psig)	120
Temperature (R)	700
Mol Weight (lb/lbmol)	19.3
Intermediate Calculations	
Specific Gravity	0.66782
Compressibility	0.97797
Density (g/cm^3)	0.00505
Result	
Viscosity (cp)	0.01371

The CNGA compressibility factor correlation is suitable for pressures above 100 psig (below 100 psig, the compressibility factor is 1)

$$Z = \frac{1}{1 + \left(\frac{344400 \cdot 10^{1.7855} P}{T^{3.825}} \right)}$$

The Lee, Gonzalez and Eakin correlation was published in 1964 and accurately predicts the viscosity of natural gases with low non-hydrocarbon content, and for temperature between 100 F - 340 F, and pressures between 14.7-8000 psia. Additionally, the correlation is only suitable for sweet gases, and does not accurately describe sour gases (as described in this paper). The correlation has standard deviation of 2.7%, with a maximum deviation of 8.99%. The correlation is

$$\mu = K \cdot \exp(X \cdot \rho^Y)$$

$$X = 2.57 + \frac{1914.5}{T} + 0.0095MW$$

$$K = \frac{0.0001(7.77 + 0.0063MW)T^{1.5}}{122.4 + 12.9MW + T}$$

$$Y = 1.11 + 0.04X$$

Gas density is predicted by this correlation.

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$$\rho = 0.0160185 \frac{P \cdot MW}{R \cdot T \cdot Z}$$

where ρ is the density in g/cm^3, P is the pressure in psig, MW is the molecular weight (lb/lbmol), R is the gas constant (10.731 ft^3 psi $^\circ$R^{-1} lb-mol^{-1}), T is the absolute temperature ($^\circ$R) and Z is the compressibility factor.

Download Excel Spreadsheet to Calculate the Viscosity of Natural Gas

Labels: excel, natural gas, viscosity

1 comments:

Unknown said...

hi Samir,
thank you for the pages,
for a mixture of C1 0.8 and C6 0.2 I have compared (in a range of temperatures and pressures) the results of these formulations with the values calculated in Excel by the free version of Prode Properties (which is available from www.prode.com), in the range 1-100 psig there are limited differences for density (Z) and viscoity while at high pressures differences are much larger,
I think there are limits in the range of application for these formulas, what is your opinion ?
Thanks,
Matt

April 27, 2013 at 8:29 AM

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