# Effects of pre fluid properties at high pressure and temperature on seismic response

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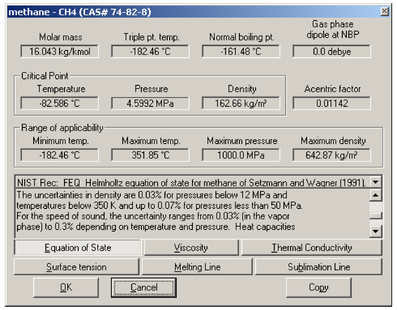
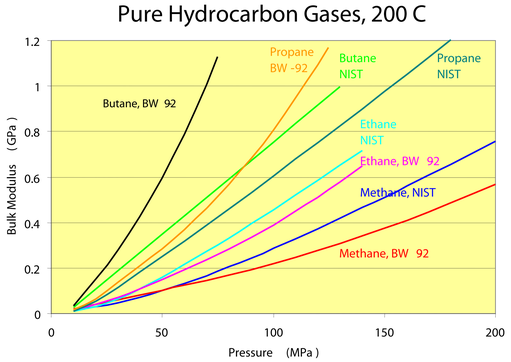
- National Inst. of Standards and Technology (NIST) publishes s/w called Refprop 7
- Pure gases and mixtures including several hydrocarbons and CO2
- Methane props to 1000 MPa and 350 C
- Adiabatic bulk modulus and density compared to Batzle-Wang, 1992 (BW-92)
- NIST s/w is open source and includes all algorithms in C++, VB, Excel and Fortran

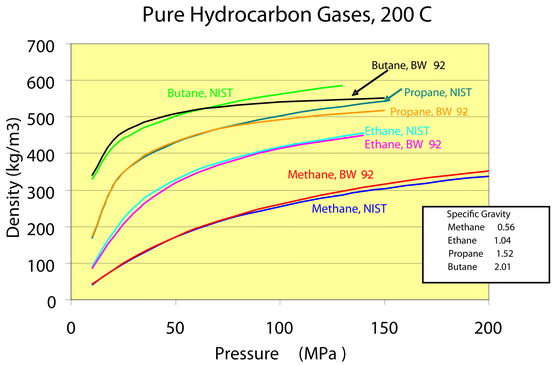



*Batzle and Wang, Geophysics, 1992 is the publication most geophysicists use to compute properties of pore fluids at reservoir conditions. Over the range of P and T that they were intended for, the relations in BW-92 are quite good. The problem is, wells are going to much greater depths now and the conditions of P and T encountered are outside the BW-92 range.*

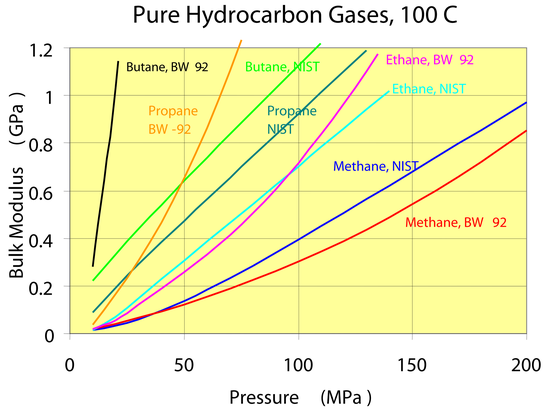
*Since many of the wells are gas producers, it would be useful to have a more reliable way to get gas properties at these P and T conditions.*



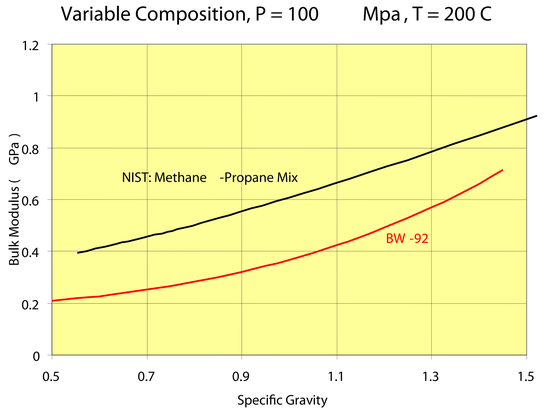

*Difference between Bulk Modulus of 4 gases as computed by REFPROP7 and BW-92 at 200 C. Difference is substantial for heavier gases like propane and butane, especially at pressure above 50 mPa (about 7500 psi).*




*Difference between density of 4 gases as computed by REFPROP7 and BW-92. Difference is fairly small for density and not significant.*




*Difference between Bulk Modulus of 4 gases as computed by REFPROP7 and BW-92 at 100 C. Difference is very substantial for heavier gases like propane and butane, especially at pressure above 50 mPa (about 7500 psi).*




*Difference in Bulk Modulus between BW-92 and NIST calculations at 110 C and 100 MPa for a range of gas specific gravity from 0.6 to 1.5. The result in REFPROP7 is obtained by mixing methane (SG = 0.56) and propane (SG = 1.52). Error in BW-92 quite large over the entire specific gravity range.*

## Conclusions

- BW-92 significantly mis-predicts adiabatic modulus of individual gases and their mixtures
- BW-92 gas densities are close enough
- No significant moduli difference between different mixes with same specific gravity
- NIST methane, propane mixes can be used for SG from 0.56 to 1.52