Current Status of Transport Properties of Hydrogen

R.T. Jacobsen[C,S]
Center for Applied Thermodynamic Studies (CATS), University of Idaho, Idaho Falls, ID, U.S.A.
rtj@uidaho.edu

J.W. Leachman and S.G. Penoncello
Center for Applied Thermodynamic Studies (CATS), Department of Mechanical Engineering, University of Idaho, Moscow, ID, U.S.A.

M.L. Huber
Physical and Chemical Properties Division, National Institute of Standards and Technology, Boulder, CO, U.S.A.

Transport properties, particularly thermal conductivity and viscosity, are needed for many engineering applications using hydrogen in system analysis and design. The currently accepted standards for transport properties of normal hydrogen and parahydrogen are based on measurement and correlation work done before 1982. While they appear to be accurate and useful, there are new requirements in engineering applications that suggest that a review of the property formulations is timely. It is important to provide accurate transport properties for heat transfer calculations and system analysis at high temperatures for applications in production, storage, transportation and utilization of hydrogen in engineering practice. Prediction, or extrapolation, of properties at extreme temperatures and pressures may be required to meet these needs in the near future. We have begun an evaluation of the available experimental data and modeling methods for wide-range application to the representation of viscosity and thermal conductivity of both normal hydrogen and parahydrogen.

This paper includes a review of the current standard transport properties models for normal hydrogen and parahydrogen, and presents comparisons of properties calculated using those models to available experimental data. Data measured and published after the completion of the current transport property standards for both normal hydrogen and parahydrogen are included in the comparisons. Recommendations for new experimental measurements needed and new transport property formulations for normal hydrogen and parahydrogen are included.