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New international formulation developed for determining the viscosity of heavy water FREE

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New international formulation developed for determining the viscosity of heavy water

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The International Association for the Properties of Water & Steam adopted the formulation as an international standard.

Heavy water, or deuterium oxide, is used in a range of industrial and medical applications, such as for measuring the average daily metabolic rate of organisms – motivating regular improvements of formulations for its thermophysical properties. The International Association for the Properties of Water & Steam (IAPWS) recently adopted a new international standard formulation, developed by Assael et al., for the calculation of the viscosity of heavy water.

The formulation is expressed in terms of temperature and density and should be used with the reference equation of state for the thermodynamic properties of heavy water, also a recently adopted IAPWS standard.

“There have been advances in the calculation of the dilute gas region and in the theory of the critical region behavior, and we have incorporated that work into guiding the behavior of the correlation in those regions,” said author Marcia Huber.

The group’s updated viscosity formulation takes these advances into account, resulting in a description of the viscosity as a function of temperature and density that is valid at a wide range of temperatures and pressures. The equation provides a determination of each individual contribution – the zero-density viscosity limit, the effects of increased density and, notably, the viscosity enhancement near the critical point.

To develop the standard, the researchers used composite data sets from multiple heavy water viscosity experiments. Additional experiments at pressures about 200 megapascals and temperatures above 473 K will help improve the calculation even further in the future.

“Accurate consensus values for the viscosity of heavy water are desirable for a wide variety of applications, including electric power generation using nuclear reactors where heavy water is used as a moderator” Huber said.

Source: “New international formulation for the viscosity of heavy water,” by M. J. Assael, S. A. Monogenidou, M. L. Huber, R. A. Perkins, and J. V. Sengers, *Journal of Physical and Chemical Reference Data* (2021). The article can be accessed at https://doi.org/10.1063/5.0048711.