Viscosity, Surface Tension, and Density of Hydrofluoroethers HFE-7000, HFE-7100, HFE-7200, HFE-7300, and HFE-7500

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International regulations on the use of chlorofluorocarbons (CFCs) based on the Montreal and Kyoto protocols from 1987 and 1997 have regarded not only hydrofluorocarbons (HFCs) but also hydrofluoroethers (HFEs) as promising alternatives to CFCs. While HFCs have become a commonplace in many applications, HFEs are still only under consideration despite the fact that they may have a lesser impact on the environment. Beside low toxicity, zero ozone depletion potential, low global warming potential, and short atmospheric lifetime, most HFEs are non-flammable and thermally stable, and thus have an excellent environmental compatibility. In spite of their potential technical importance, a lack of data for HFEs can be presently established. This is valid especially for the transport properties, but also for the equilibrium data. The major objective of this investigation consists in making a contribution to the improvement and verification of the actual data situation of HFE-7000 (1,1,1,2,2,3,3-heptafluoro-3-methoxy-propane), HFE-7100 (1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane), HFE-7200 (1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane), HFE-7300 (1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane), and HFE-7500 (3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl)-hexane). For these HFEs, the kinematic viscosity of the liquid phase and the surface tension were studied in dependence on temperature under saturation conditions by surface light scattering (SLS). The kinematic viscosity and surface tension were obtained for temperatures between (273.15 and 373.15) K with an estimated expanded uncertainty ($k = 2$) of less than ±2% and ±1%. In addition, a vibrating tube densimeter was used for the measurement of density at temperatures from (273.15 to 363.15) K, and the results have an expanded uncertainty ($k = 2$) of ±0.02%. The measured density, kinematic viscosity, and surface tension are represented by interpolating expressions with differences between the experimental and calculated values that are comparable with but always smaller than the expanded uncertainties ($k = 2$). Due to the lack of literature data, a data comparison can be drawn only for some specific points.