Thermophysical Property Measurements of Linear Siloxanes

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The Organic Rankine Cycle (ORC) uses heat to produce electricity and is a particularly efficient solution when the temperature of the heat source is relatively low, as is the case with renewable energy sources such as geothermal, solar, and biomass. Siloxanes exhibit properties, such as low toxicity and flammability and chemical stability at high temperatures, that make them good candidates for working fluids in high-temperature ORC processes. The optimal design and operation of key ORC components, such as expansion devices, heat exchangers, and condensers, require accurate thermophysical property data for the working fluids of interest. Unfortunately, for siloxanes, the availability of pertinent experimental data is relatively limited. In this work, we present valuable density, sound speed, and heat capacity data for four linear siloxanes: hexamethyldisiloxane (MM, $C_6H_{18}OSi_2$), octamethyltrisiloxane (MDM, $C_8H_{24}O_2Si_3$), decamethyltetrasiloxane (MD_2M, $C_{10}H_{30}O_3Si_4$), and dodecamethylpentasiloxane (MD_3M, $C_{12}H_{36}O_4Si_5$). Density and speed of sound were simultaneously measured over the combined temperature range 278 K to 343 K and at atmospheric pressure. Heat capacity measurements were made using modulated differential scanning calorimetry over the combined temperature range 273 K to 473 K. Experimental data, including an assessment of the associated expanded uncertainties, will be presented. Additionally, measurement results will be compared to available literature data and to existing equations of state.