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NASA TECH BRIEF

Viscosity and Density of Methanol/Water Mixtures at Low Temperatures

Viscosity and Density of Three Methanol/Water Mixtures at Various Temperatures (°K)

	Mixture 1		Mixture 2		Mixture 3	
Temperature	Viscosity	Density	Viscosity	Density	Viscosity	Density
283.16	1.64	0.8553	1.75	0.8623	1.52	0.8466
273.16	2.07	--	--	--	--	--
258.16	3.06	0.8759	3.38	0.8821	2.75	0.8671
253.16	3.53	--	--	--	--	--
233.16	6.87	0.8954	7.93	0.9014	5.87	0.8874
213.16	16.4	--	--	--	--	--
208.16	21.3	0.9155	26.5	0.9211	16.9	0.9080
193.16	55.0	--	--	--	--	--
183.16	127.	0.9364	176.	0.9411	86.8	0.9295
173.16	359.	0.9456	538.	0.9500	229.	0.9390

Viscosity and density of three separate methanol/water mixtures were determined over the temperature range from +10°C (283.16°K) to −100°C (173.16°K). The data, required for a cooling system using the methanol/water mixtures, was not available in the literature. The measured values for each of the three mixtures are given in the table. The respective weight percentages of methanol in mixtures 1, 2, and 3 were as follows: 79.9, 77.0, and 83.0. Viscosities are given in centistokes, and densities are given in grams per milliliter for the indicated temperatures expressed in degrees Kelvin.

The mixtures were prepared from analytical grade, anhydrous, acetone-free methanol and distilled water. A few of the viscosities (of the 79.9% methanol mixture) were determined by a modification of the falling cylinder method (described in *AIChE Journal*, September 1966, pages 932–936); the rest of the viscosity measurements were made with a calibrated viscometer described in ASTM D 445. Density was determined by measuring the volume of a weighed amount of each mixture contained in a calibrated glass cell placed in a constant-temperature bath.

The constant temperature bath consisted of an agitated glass Dewar flask with two unsilvered strips to allow visual observation. An 80% methanol/water mixture was used as the bath fluid. The bath was cooled by vaporizing liquid nitrogen in a coil within the bath, and the temperature was controlled by an electrically heated nichrome wire coil. The temperature control system consisted of a platinum resistance thermometer, a Mueller bridge, a dc null detector, a dc amplifier, and the nichrome wire heating coil. The resistance corresponding to the desired temperature was set on the Mueller bridge. The difference between the bridge setting and the resistance of the thermometer represented the deviation in the temperature from the desired value. This error signal was sent to

(continued overleaf)

the null detector which amplified the signal and provided the input for the dc amplifier. The dc amplifier output provided the electrical power to the nichrome heater. This system permitted the measurement and control of the temperature to within 0.01°C.

Note:

Additional details may be obtained from:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
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Patent status:

No patent action is contemplated by NASA.

Source: J. G. Austin
of Marshall Space Flight Center
and F. Kurata and G. W. Swift
of the University of Kansas
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