Density and ultrasound velocity of some pure metals in liquid state.

P S Popel[1], V E Sidorov[1], D A Yagodin[1], G M Sivkov[1], A G Mozgovoj[2]

[1]*Department of Physics, Urals State Pedagogical University, Ekaterinburg, Russia*
[2]*Institute for High Temperatures, Moscow, Russia*
E-mail: sidorov@uspu.ru

The main aim of this work is a metrological test of experimental installations for density (d) and ultrasound velocity (V_s) determination in liquid metals and alloys in a wide temperature range. Density was measured using absolute variant of gamma-absorption technique with accuracy of 0,5%. Ultrasound velocity data were obtained by pulse-phase method at frequency of 31,33 MHz with accuracy of 0,2%. The sensitivity for both methods was lower than 0,1%. We studied density of aluminium, gallium, palladium, bismuth, cooper and silver and ultrasound velocity of bismuth, gallium and silver. In the last case only low-melted metals were used due to the temperature limitation of quartz crucibles. The purity of all metals was higher than 99,99%. The results are given in tables 1 and 2.

Table 1. Density and its temperature coefficient taken from equation $d = d_L^* - A(T- T_L^*)$.

Metal	d_L, kg/m^3		A, kg/(m^3·K)		Temperature range, K
	experiment	[1]	experiment	[1]	
Al	2406	2410	0,327	0,337	T_L-1823
Ga	6055	6080	0,606	0,6	T_L-1500
Pd	10577	10380	1,055	1,169	T_L-1973
Bi	9919	10120	1,260	0,97	T_L-1333
Cu	7880	8039	0,725	0,96	T_L-1873
Ag	9214	9320	1,042	0,97	T_L-1573

* here d_L – density at melting point T_L.

Table 2. Ultrasound velocity and its temperature coefficient.

Metal	υ_s, m/s		$d\upsilon_s/dT$, m/(s·K)		Temperature range, K
	experiment	[2]	experiment	[2]	
Bi	1645	1674 (544K)	-0,061	~ 0	T_L-595
			-0,182	-0,18	595-800
			-0,234	-0,22	800-1270
			-0,279	-	1270-1375
Ag	2666	2710 (1243K)	-0,407	-0,41	T_L-1450
Ga	2877	2873 (303K)	-0,269	-0,3	T_L-1400

The extension of temperature range in ultrasound velocity determination allowed us to fix the abnormal behavior of quantity for Bi and Ga at 1170 and 1270 K respectively.

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2. M B Gitis and I G Mikhailov, Acoustics J., **12** (1966) 151-159.