U. S. DEPARTMENT OF COMMERCE
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National Bureau of Standards

Certificate of Analyses

Standard Sample 158

Silicon Bronze

ANALYST	COPPER Electrolytic	SILICON	ZINC ZnS-ZnO	IRON	MANGANESE Colorimetric	TIN	ALUMINUM	NICKEL Colorimetric	LEAD	
1	[a]90.87	[b]2.72	2.05	[c]1.47	[d]1.30	[e]0.98	[f]0.53	[g]0.0056	[h]0.005	
2	[i]90.87	[j]2.72	2.06	[c]1.47	[k]1.31	[l].96	[m].54	[g].0064	[n].003	
3	[a]90.87	[b]2.71 [o]2.70	2.09	[p]1.48	[q]1.31	[r].97	[s].53	[g].006		
4	[t]90.84	[b]2.72 [u]2.71	2.10	[c]1.48	[k]1.31	[v].96	[w].55	[g].0064	[h].002	
	[x]90.84	[o]2.72	[y]2.06	[c]1.50	[z]1.30		[w].55			
6	[x]90.84	[b]2.74	2.06	[c]1.48	[z]1.33	[z1].99	[z2].56	[z3].006	[z4].003 [z5].005	
7	[i]90.86	[b]2.72	2.07	[c]1.49	[k]1.30	[v].97	[z6].54	[g].0056		
Average	90.86	2.72	2.07	1.48	1.31	0.97	0.54	0.006	0.004	

[a] Five-gram sample dissolved in 45 ml of HNO_3 (1:1) containing 1 to 2 ml of HF (48%). Nineteen mg of lead as $Pb(NO_3)_2$, and 2 drops of 0.1 *N* HCl added, the solution diluted to 350 ml, and electrolyzed overnight using a current density of 0.5 amp/dm². Silicon in the electrolyte removed with H_2SO_4-HF treatment, and tin with HBr. Residual copper separated with H_2S and determined by electrolysis.

[b] Double dehydration with H_2SO_4 with intervening filtration.

[c] $SnCl_2$-$K_2Cr_2O_7$ method.

[d] Persulfate-arsenite method with potentiometric titration.

[e] Tin separated by distillation from a 5-g sample, precipitated with cupferron, and ignited to SnO_2. See J. Research NBS **33**, 307 (1944) RP1610.

[f] Copper removed from a 2-g sample by electrolysis in an HNO_3-HF solution as in footnote a. Mercury cathode separation then made in sulfate solution followed by an H_2S separation in 0.01 *N* acidity. Sulfides filtered off, and MnO_2 removed with persulfate in dilute acid solution. Aluminum precipitated with NH_4OH and ignited to Al_2O_3.

[g] Dimethylglyoxime-photometric method.

[h] Dithizone method.

[i] Silicon removed from a 5-g sample prior to electrolysis.

[j] Double dehydration with H_2SO_4 with intervening filtration. Traces of silicon recovered in second filtrate by NH_4OH precipitation and subsequent $HClO_4$ dehydration.

[k] KIO_4-photometric method.

[l] Tin reduced with nickel and titrated with KIO_3.

[m] Mercury cathode-cupferron-8,hydroxyquinoline method. See ASTM method E76–50.

[n] Polarographic method.

[o] $HClO_4$ dehydration.

[p] Iron reduced with granular zinc or with H_2S and titrated with $Ce(SO_4)_2$.

[q] MnO_2 precipitated with $KClO_3$, and dissolved in H_2SO_4 containing a slight excess of $Na_2C_2O_4$. Excess oxalate titrated with $KMnO_4$.

[r] Tin reduced with iron plus antimony and titrated with KIO_3.

[s] Aluminum precipitated with 8-hydroxyquinoline and titrated with $KBrO_3$.

[t] Direct electrolysis of a 2-g sample in an HNO_3-HF solution containing a small amount of added lead. See ASTM method E54–49.

[u] Molybdisilicic acid-photometric method. See ASTM method E62–50.

[v] Tin reduced with aluminum and titrated with KIO_3. See ASTM method E54–49.

[w] Mercury cathode-Al_2O_3 method. See ASTM method E54–49.

[x] Copper deposited in the presence of silicon and tin in an HNO_3-HF solution of a 1-g sample.

[y] Copper in the filtrate from the silicon determination (footnote [o]) removed by electrolysis. Electrolyte evaporated to fumes of H_2SO_4 and the solution treated with an excess of NaOH and filtered. Zinc determined in the filtrate by electrolysis.

[z] Bismuthate method.

[z1] Tin reduced with lead and titrated with iodine.

[z2] 8-hydroxyquinoline method.

[z3] Dimethylglyoxime-gravimetric method.

[z4] PbS-colorimetric method.

[z5] Weighed as $PbCrO_4$.

[z6] Mercury cathode-cupferron-Al_2O_3 method.

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