

Rapid Analysis of some Coinage, Jewellery, Aluminium Bronze and Ternary Alloys by the Ring oven Technique

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Abstract

Schemes have been worked out for the quantitative separation and subsequent determination of the constituents in a number of alloys containing Au—Cu, Cu—Al, Fe—Au and Fe—Cu—Al by the ring oven technique. Gold is migrated to the ring zone by extraction with n-butanol at pH = 1.5 and iron or copper with acetylacetone. Aluminium is moved to the ring zone by acidified ethanol.

Rings of Au, Cu, Fe and Al are developed with suitable reagents and the intensities of several rings are compared with those in the standard scale by ring colorimetry. The amount of these ions and thereby the composition of the alloy may be obtained. The total time required for the analysis exclusive of the time required for the preparation of the standard scales does not require more than 30 minutes.

In earlier communications¹⁾²⁾³⁾ from these laboratories, schemes for the analysis of various metal mixtures by the ring oven method have been described. The present paper describes suitable schemes for the analysis of a number of alloys containing Au, Cu, Fe and Al in binary and ternary systems.

Experimental

Apparatus: WEISZ'ring oven (National Appliances Co., U. S. A.) was used as described earlier⁴⁾.

Reagents: 2% solution of benzidine in acetic acid, 5% solution of potassium ferrocyanide, and 2% solution of aluminon with 5 ml of 4% CH₃COONH₄ were prepared.

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¹⁾ R. CHATTERJEE and A. K. DEY, *Ind. J. App. Chem.* **26**, 97 (1963).

²⁾ E. J. SINGH and A. K. DEY, *Ind. J. Chem.* **1**, 455 (1963).

³⁾ E. J. SINGH and A. K. DEY, *J. Ind. Chem. Soc.* **40**, 222 (1963).

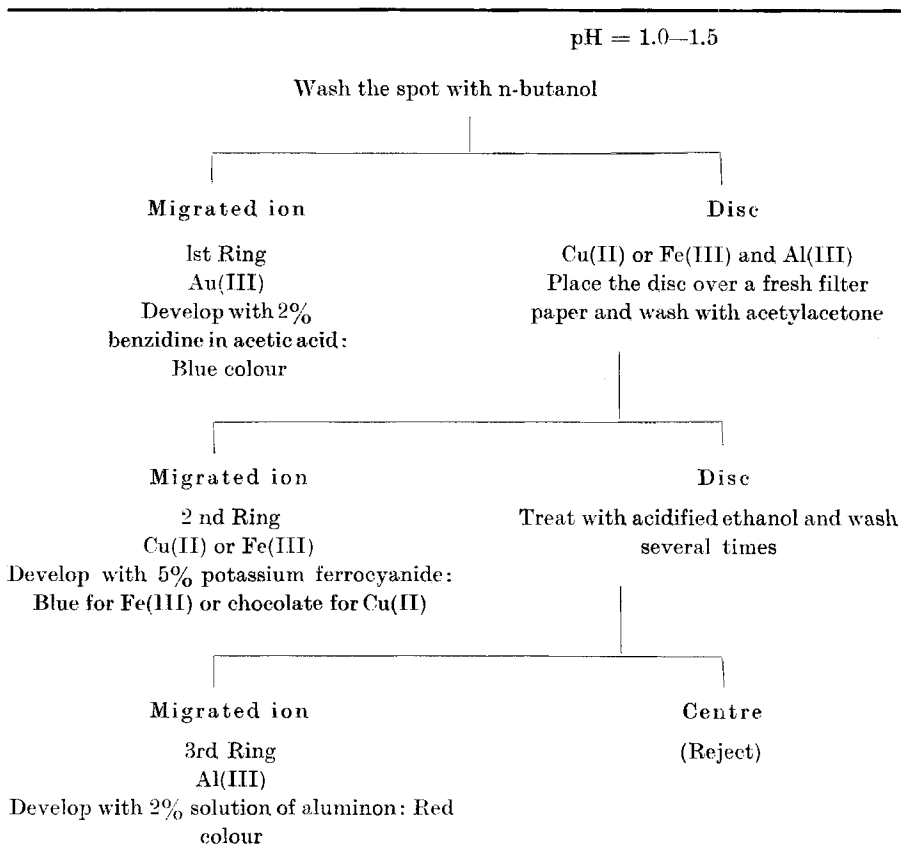
⁴⁾ A. K. DEY and E. J. SINGH, *Microchemical Techniques*, Ed. N. D. Cheronis, Interscience, New York (1962).

Samples Analysed: (a) Gold-Copper Alloy: (i) Coinage, (ii and iii) Jewellery alloys (two samples), (iv) dark redgold. (b) Gold-Iron Alloy: (i) Blue gold. (c) Aluminium-Copper Alloy: (i) Lynite, body alloy, (ii) Aluminium bronze. (d) Copper-Aluminium-Iron Alloy: (i) Resistac, (ii) Ampco metal.

Samples of alloys were from standard sources, but in cases where samples were not available, artificial mixtures were prepared by mixing the solutions in required proportions.

Procedure: Solutions of alloys were prepared by weighing the pieces of alloys directly and dissolving them separately in nitric acid or aquaregia. They were made upto known volumes and labelled. Each alloy solution was analysed by following schemes (Table 1 and 2).

Table 1
Analysis of the Mixture of Gold, Copper or Iron and Aluminium



The solution of the alloy was spotted on the centre of marked circular paper (WHATMAN No. 1; 50 mm diameter) using a micropipette (ca. 1.5 μ l), dried and separated as described above. Several test rings were obtained with varying number of drops of test solution.

Table 2
Analysis of the Mixture of Copper, Aluminium and Iron

Treat the spot with NH_4Cl and NH_4OH and wash with acetylacetone (two washings)

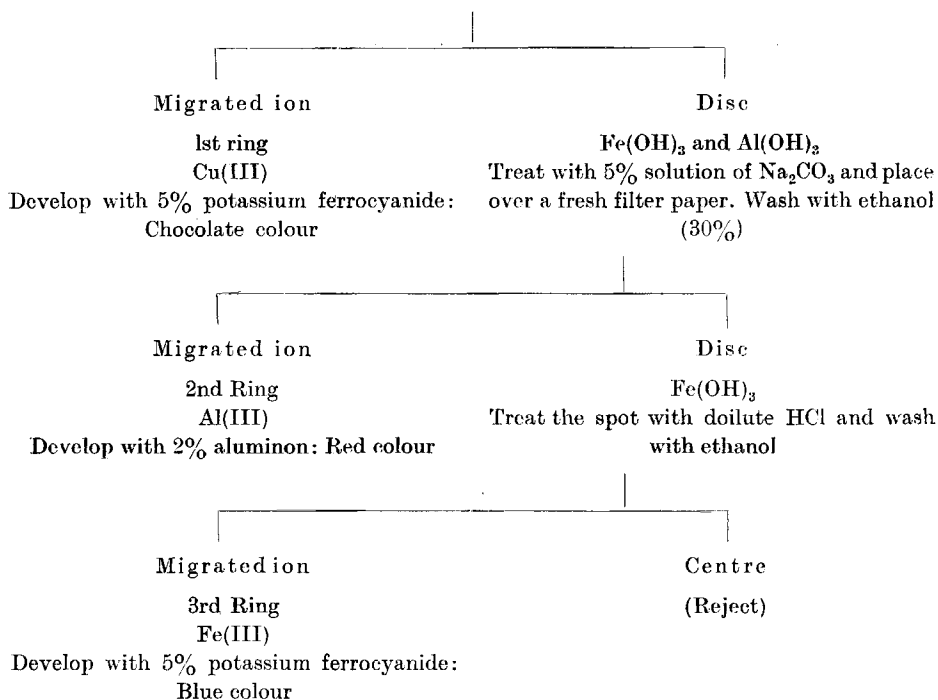


Table 3
Determination of the Composition of Alloys by Ring Colorimetry

Alloy	% Composition of Alloys					
	Theoretical			Found		
	Au	Cu	Al	Au	Cu	Al
Coinage	90	10	—	87	10	—
Jewellery ²⁾	75	25	—	71	25	—
Jewellery ¹⁾	84	16	—	83	16	—
Dark red gold	50	50	—	50	50	—
Lynite, body alloy	—	5	95	—	5	5
Aluminium bronze	—	90	10	—	90	10
Resistac	Fe	Cu	Al	Fe	Cu	Al
	2	90	8	2.5	92	3
Ampco metal	7	80	10	8	81	6
	Fe	Au		Fe	Au	
Blue gold	25	75		25	70	

Standard rings of Au, Cu, Fe and Al were prepared with varying number of drops using the same micropipette for obtaining rings of varying concentrations to match with the test rings⁵⁾. The results are summarised in table 3.

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⁵⁾ H. WEISZ, *Microanalysis by Ring Oven Technique*, Pergamon Press, London (1961).

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