ON THE ELECTROLYTIC DEPOSITION OF METALS FROM THEIR PYROPHOSPHATE SOLUTIONS.

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Pyrophosphates of various metals dissolve in alkali pyrophosphate solutions to form complex salts which are generally thought to have such compositions as represented by $Na_2[M^{II}P_2O_7]\cdot xH_2O$ or $Na[M^{III}P_2O_7]\cdot xH_2O$. As to the electrolytic deposition of metals from these complex pyrophosphate solutions A. Brand[1] conducted some experiments long ago. The present author has studied the electrolytic deposition of nickel, cobalt, copper, zinc, and cadmium from their complex pyrophosphate solutions with Classen's electrode in order to find best conditions for the analysis of these metals. Iron was found not to be deposited completely from the pyrophosphate solution. For the other metals, especially for zinc and cadminum which were hitherto known to give no satisfactory deposit, the method was found to give very trustworthy result.

Nickel. Nickel sulphate was taken as the sample, and its pyrophosphate solution mixed with some ammonium carbonate was used as the electrolyte.

Ni (as $NiSO_4\cdot 7H_2O$)	$Na_4P_2O_7\cdot 10H_2O$	$(NH_4)_2CO_3$	Volume	Amp.	Volt	Temp.	No. of rotation	Time
0.1–0.3 g.	3.0–5.0 g.	3.0–4.0 g.	120 c.c.	1.0–2.0	6.0–7.0	ord. temp.	800 per min.	90–120 min.

Cobalt. Cobalt sulphate was used for analysis. The amount of cobalt taken for analysis should be kept below 0.2 g.; otherwise the deposit acquires somewhat dark appearance.

Co (as $CoSO_4\cdot 7H_2O$)	$Na_4P_2O_7\cdot 10H_2O$	$(NH_4)_2CO_3$	Volume	Amp.	Volt	Temp.	No. of rotation	Time
0.1–0.2 g.	4.0–5.0 g.	1.0–2.0 g.	125 c.c.	1.0–1.5	6.0–7.0	ord. temp.	800 per min.	70–100 min.

Copper. The pyrophosphate solution mixed with some ammonium nitrate was found to give the best result.

(1) *Z. anal. Chem.*, **28** (1889), 581.

Cu (as $CuSO_4 \cdot 5H_2O$)	$Na_4P_2O_7 \cdot 10H_2O$	NH_4NO_3	Volume	Amp.	Volt	Temp.	No. of rotation	Time
0.1–0.3 g.	7.0–8.0 g.	3.0–5.0 g.	120 c.c.	1.0–1.5	4.0–5.0	ord. temp.	800 per min.	90–120 min.

Zinc. Zinc pyrophosphate solution with the addition of ammonium nitrate was taken as the electrolyte, and electrolysis was conducted with the cathode previously electroplated with copper.

Zn (as $ZnSO_4 \cdot 7H_2O$)	$Na_4P_2O_7 \cdot 10H_2O$	NH_4NO_3	Volume	Amp.	Volt	Temp.	No. of rotation	Time
0.2 g.	7.0 g.	0.5–1.0 g.	125 c.c.	1.0–1.5	6.0–7.0	ord. temp.	500 per min.	120 min.

Cadmium. The conditions for its analysis were very similar to those for zinc determination.

Cd (as $3CdSO_4 \cdot 8H_2O$)	$Na_4P_2O_7 \cdot 10H_2O$	NH_4NO_3	Volume	Amp.	Volt	Temp.	No. of rotation	Time
0.1–0.2 g.	9.0 g.	1.0 g.	125 c.c.	2.0–2.5	5.5–6.0	ord. temp.	500–600 per min.	120 min.

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