Aim and Scope of the Present Work
CHAPTER III

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Water pollution by industrial wastes has been well recognised as a major threat to humanity. As newer and newer processes are developed in order to meet the demands in terms of applications, newer pollution problems crop up. Polluted water let out by electroplating and metal finishing industries is in no way of small volumes.

Zinc, cadmium, copper, silver and brass are mainly electrodeposited from cyanide solutions because they exhibit high throwing power and uniform deposition characteristics and avoid chemical deposition. As small a quantity as 50 ppm of cyanide will generate a lethal concentration of cyanogens in sewer atmospheres. Cyanide concentrations above 0.1 ppm can be fatal to fish and other aquatic life in open water. With a view to overcome such dangerous consequences, strict waste-disposal requirements have been imposed in different countries. In order to minimize or eliminate pollution due to toxic or hazardous waste waters, a large volume of research is being performed to develop pollution-free processes.

In today's technology zinc is preferably deposited from acid-type electrolytes, especially from chloride electrolytes as an alternative to the earlier used electrolytes based on cyanide, which are highly toxic and the methods of cyanide destruction in the effluent require substantial investment. The chloride-based electrolyte is also now open to the objection due to its corrosivity and less tolerance to metallic impurities. A survey of literature shows that practically no work has been carried out on electrodeposition of zinc from bromide-based electrolytes. In the case of electrodeposition of nickel, sulphamate bath with bromide ions has been reported to produce deposits with low stress. Hence, in this proposed programme, electrodeposition of zinc from bromide-based electrolytes has been taken for detailed study.
The search for eco-friendly plating baths to replace cyanide and cadmium in plating resulted in a numerous complexing agents and alloy deposition. To replace cadmium under marine atmospheres, zinc-nickel alloy electrodeposits are used. There are potential economic advantages in using Zn-Ni to replace cadmium coatings. Hence, an attempt has also been taken for the development of Zn-Ni alloy bath based on bromide electrolytes.

The following aspects have been studied in the present work.

i. Hull cell studies to optimize the bath constituents and operating parameters for the deposition of zinc and zinc-nickel alloy on steel from bromide-based electrolytes.

ii. The effect of a few chosen addition agents on the nature of zinc deposits.

iii. Determination of the current efficiency, conductivity, cathode polarization and throwing power of the baths.

iv. Study of the physical properties of deposits such as adhesion, porosity and microhardness.

v. Study of the corrosion resistance of the deposits both by electrochemical methods viz. potentiodynamic polarization and impedance measurements and by non-electrochemical method.

vi. Determination of the orientation of the crystal structure using XRD and the structure of the deposits using SEM.

vii. Study of the reaction mechanism of deposition of zinc and zinc-nickel alloy from bromide-based electrolytes using cyclic voltammetry.