FORMAT OF THE THESIS

The title of the present investigation is synthesis and characterization of nanocrystalline nickel on aluminium by electroless deposition method. The entire thesis is divided into six chapters.

The first chapter presents brief introduction about nanocrystalline metals, nanocrystalline nickel, anodization, electroless deposition of nickel on aluminium, corrosion, and surface characterization techniques along with review of literature and objectives of the present investigation. The references corresponding to the contents are given at the end of this chapter.

Chapter 2 describes various experimental techniques used in this investigation. Electroless plating of nickel, measurements, surface analysis, electrochemical behaviour and corrosion studies were elaborately given at the end of this chapter.

Chapter 3 to chapter 5 presents the results and discussion on synthesis and characterization of NC-Ni-P on aluminium. Chapter 3 for sodium acetate bath, chapter 4 for tri-sodium citrate bath and chapter 5 for glycine baths, chapter 3, 4 and 5 are further subdivided into two sections as ‘a’ and ‘b’ for zincated and anodized aluminium respectively.

Chapter 3a gives the optimization of electroless plating of nanocrystalline Ni-P on zincated aluminium using sodium acetate bath. The effect of concentration of nickel ion, sodium acetate, sodium hypophosphite, pH, temperature, surface area/volume ratio and
plating time on thickness, rate of deposition, at.%P, at.%Ni are discussed and the data are presented in the form of tables and figures. Influence of various parameters on corrosion resistance of the coatings, redox behaviour, surface morphology, elemental composition, roughness, crystal size, structure and type of coating before and after heat treatment are given in tables and figures and discussed. In the last section, the conclusions of investigation on electroless deposition of Ni-P coatings are given.

Chapter 3b discloses the formation of NC-NiP on anodized aluminium using optimized sodium acetate bath. Effect of various parameters on thickness, atomic percent of P and plating time on elemental analysis, crystal size, roughness and reflectance of the black coating are discussed. At the end, corrosion behaviour of the nanocrystalline Ni-P coatings on anodized aluminium before and after heat treatment are compared and discussed.

Chapter 4a gives the results of optimization of electroless nanocrystalline Ni-P on zincated aluminium using tri-sodium citrate bath. The plating parameters on thickness, rate of deposition, at.% P, at.% Ni are discussed. Effect of plating time on redox behaviour, corrosion resistance of the coatings, surface morphology, roughness, crystal size, type of coating before and after heat treatment are given in tables and figures and discussed.

Chapter 4b deals with synthesis of NC-Ni-P on anodized aluminium using optimized tri-sodium citrate bath. The effect of concentration of nickel ion, tri-sodium citrate, sodium hypophosphite, pH, temperature and time on thickness, rate of deposition,
atomic % of P, colour and reflectance of the NC-Ni-P coatings have been discussed with the help of tables and figures. Influence of plating time on elemental analysis, crystal size and surface morphology and corrosion resistance of the black coatings before and after heat treatment are compared and discussed.

Chapter 5a gives the results of optimization of electroless plating of nanocrystalline Ni-P on zincated aluminium using glycine bath. The effect of concentration of nickel ion, glycine, sodium hypophosphite, pH, temperature, surface area/volume ratio and plating time on thickness, rate of deposition, at.% of P and Ni are discussed and the data are presented in the form of figures. Dependence of redox behaviour, corrosion resistance, surface morphology, roughness, crystal size and type of coating before and after heat treatment on plating time is also discussed.

Chapter 5b presents the results of synthesis of NC-Ni-P on anodized aluminium using optimized glycine bath. The effect of plating time on elemental analysis, crystal size, roughness, reflectance, corrosion rate, corrosion resistance and surface morphology of nanocrystalline Ni-P coatings formed on anodized aluminium before and after heat treatment are compared and discussed. The references are given in the last section.

Chapter 6 gives the summary and conclusions of the work carried out on synthesis of NC-Ni-P deposits on zincated and anodized aluminium from sodium acetate, tri-sodium citrate and glycine baths by electroless deposition method. Conclusions are summarized at the end of the thesis with recommendations for the future work. The lists of papers arising from the results embodied in the thesis are given at the end.