

Fig. 4-1. Schematic sketch of the electrochemical equipment used in this chapter.

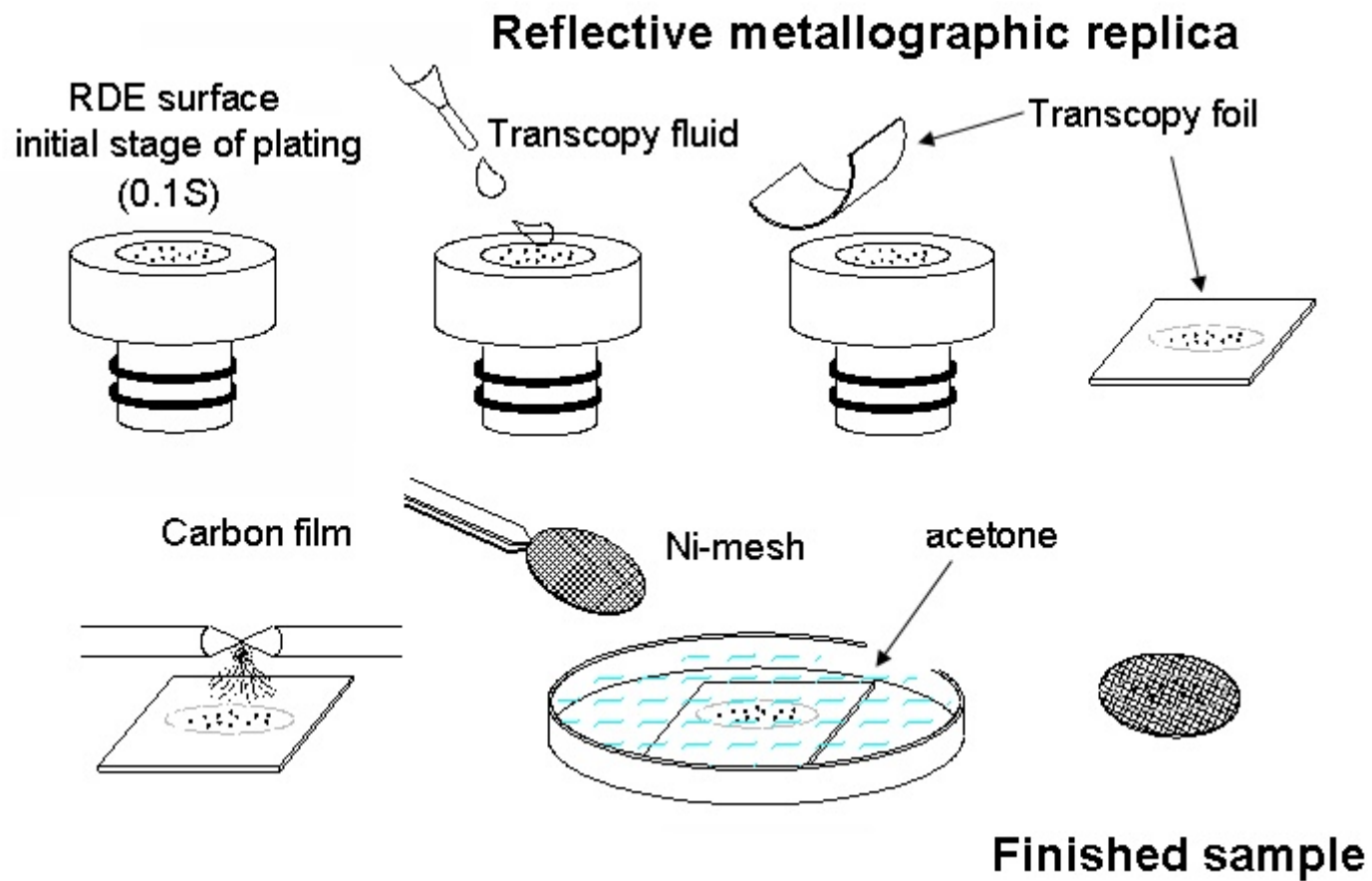


Fig. 4-2. Schematic representation of the preparation steps of carbon-extraction TEM sample.

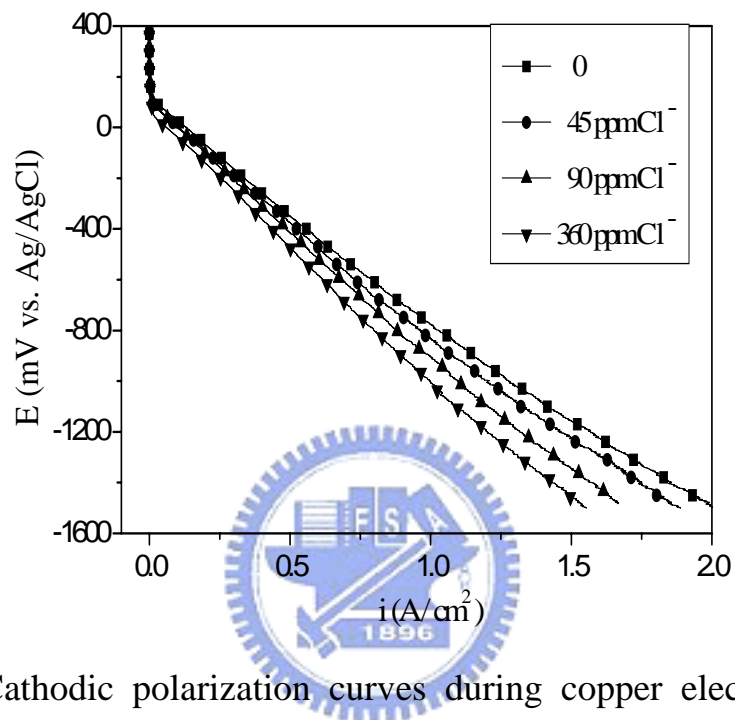
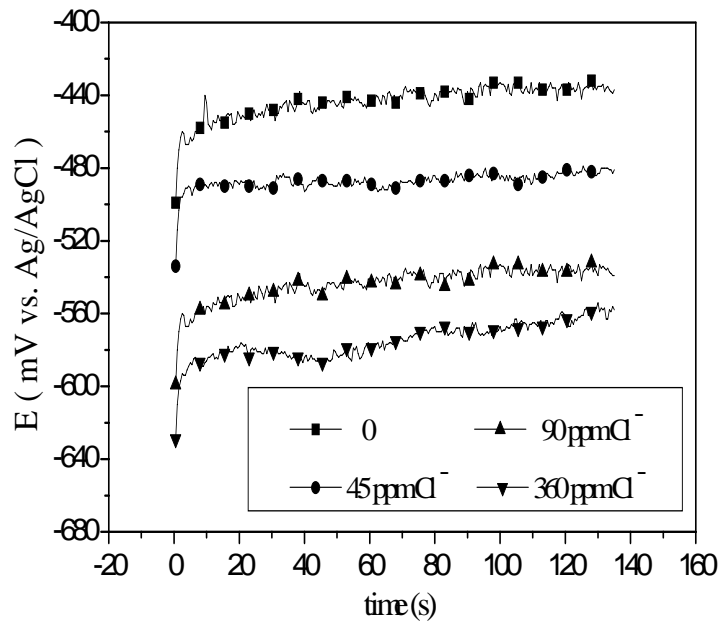
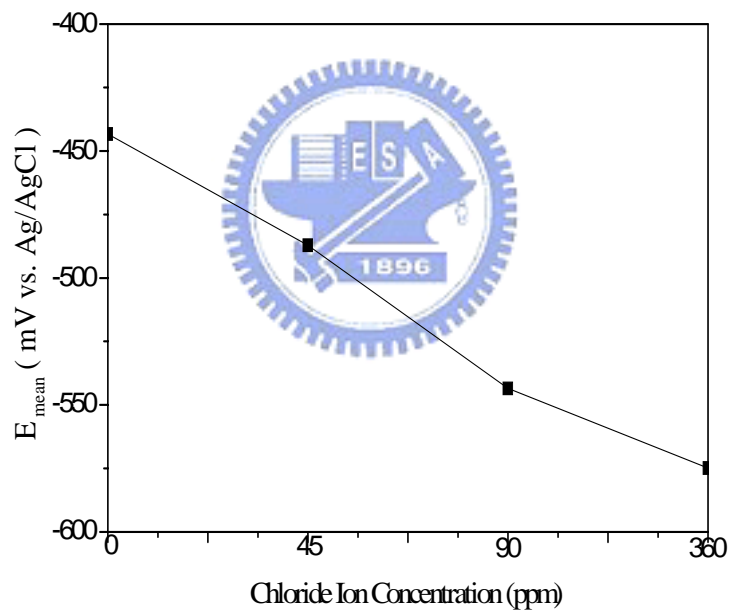


Fig. 4-3. Cathodic polarization curves during copper electroplating at 65°C in sulphuric acid solutions containing different Cl⁻ concentrations.

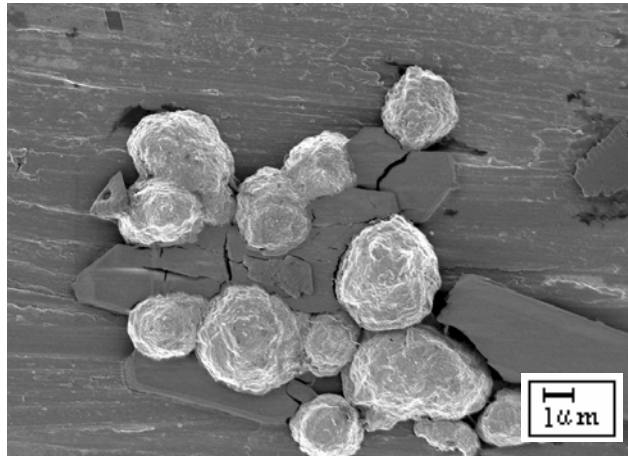


(a)

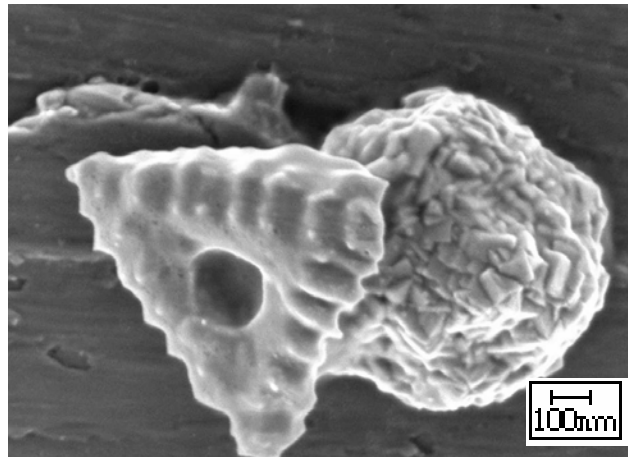


(b)

Fig. 4-4. (a) Cathodic potentials monitored during galvanostatic plating at 0.7 A/cm^2 on a Ti substrate. (b) Effect of Cl^- concentration in solution on cathodic potential after 135 s of galvanostatic plating at 0.7 A/cm^2 .



(a)



(b)

Fig. 4-5. SEM micrographs showing the copper cluster and cupreous chloride triangle after electroplating for (a) 0.1 s and (b) magnified micrograph of (a).

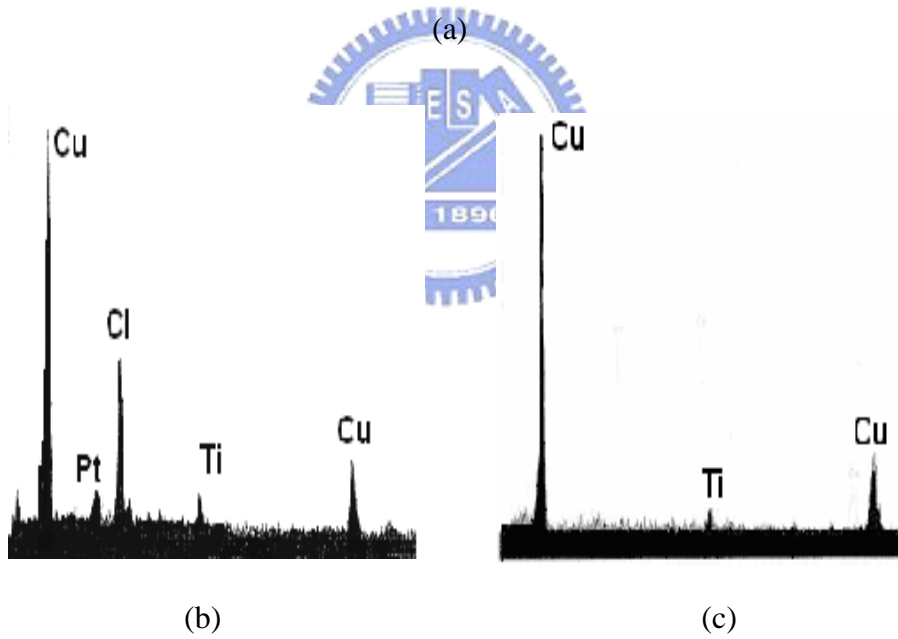
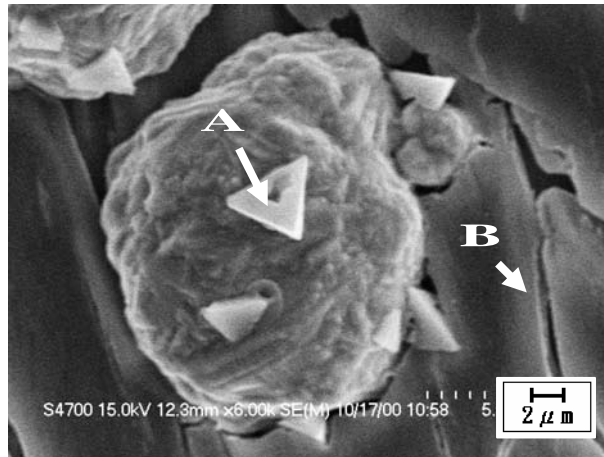


Fig. 4-6. (a) SEM micrographs showing the copper cluster and cupreous chloride triangle after electroplating for 3 s, (b) EDS-analysis on point A in Fig. 4-6a, and (c) EDS-analysis on point B in Fig. 4-6a.

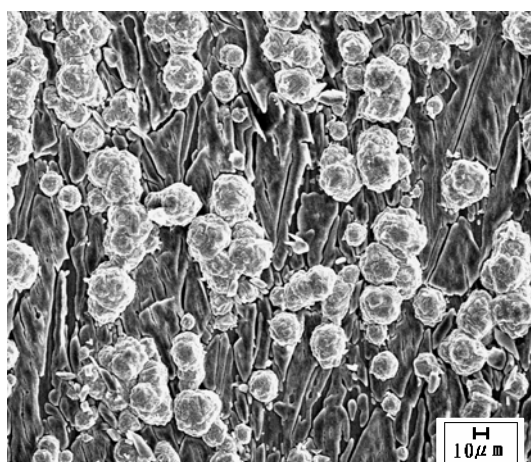
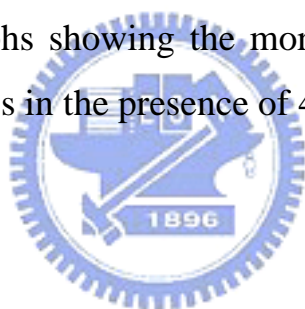
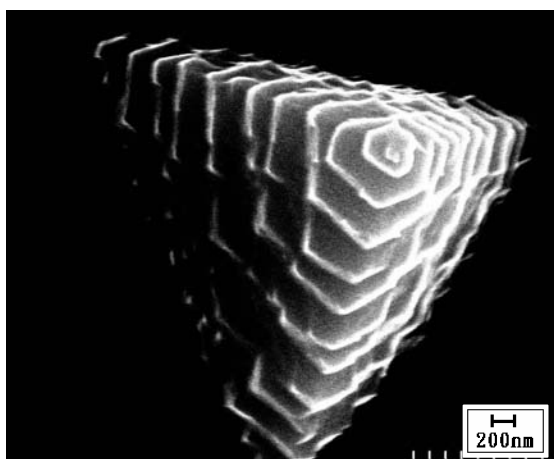
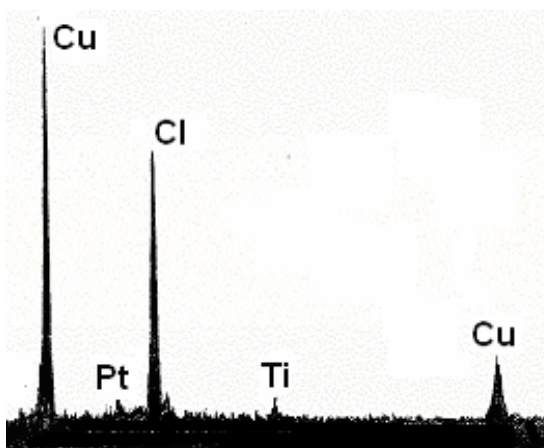


Fig. 4-7. SEM micrographs showing the morphology of copper deposit after electroplating for 10 s in the presence of 45 ppm Cl^- .





(a)



(b)

Fig. 4-8. (a) FESEM micrograph showing the pyramid-shaped CuCl after electroplating for 1 s at higher magnification, (b) the EDS-analysis of the pyramid CuCl.

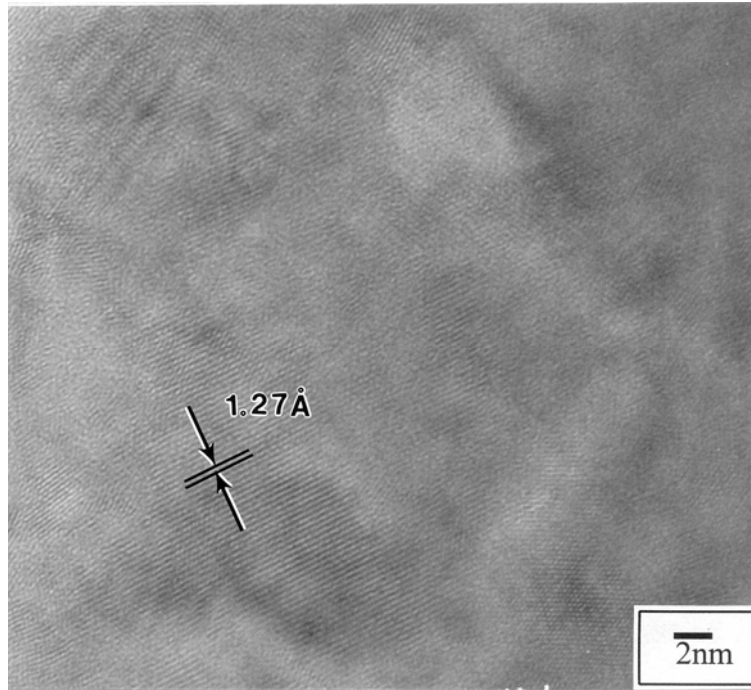
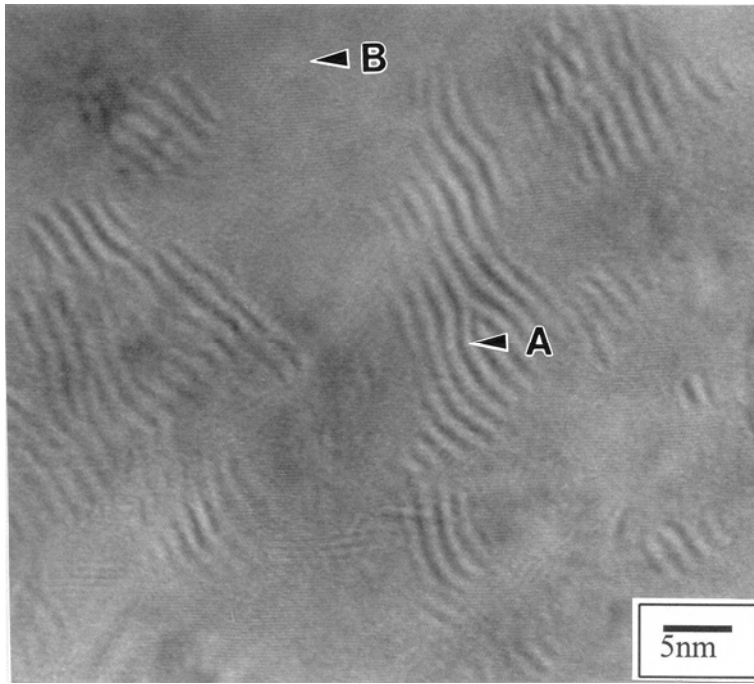
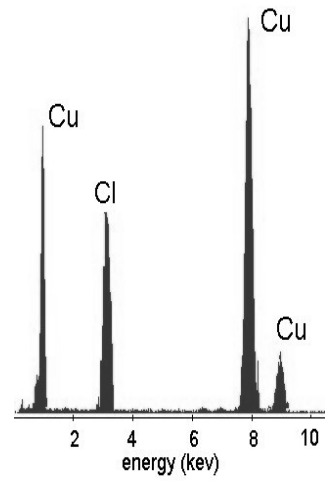


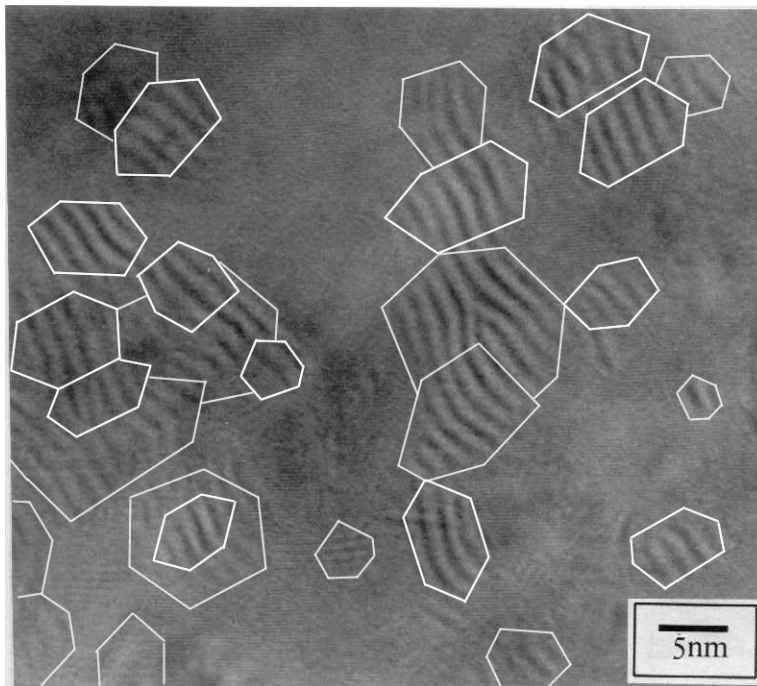
Fig. 4-9. HRTEM image of deposit formed in the absence of Cl⁻. The plane in the image is located at the inner surface of the coating adjacent to the Ti substrate.



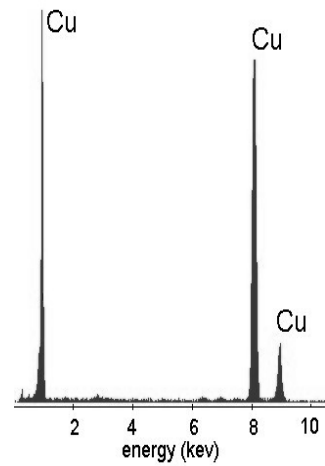
(a)



(c)



(b)



(d)

Fig. 4-10. (a) HRTEM image of 5 micron thick deposit formed in the presence of 360 ppm Cl⁻. The plane in the image is located at the inner surface adjacent to the Ti substrate. (b) Outlines of the hexagonal CuCl precipitate in image shown in (a). (c) EDS analysis on point A in (a). (d) EDS analysis on point B (a).