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Sono-Electroplating of Zn-Ni Alloy Film From Ammonia Bath

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Abstract – The smooth and clear plated films obtained below 100 mA.cm^{-2} in the sonication. The alloy film plated in the range of 0.25 - 0.75. Ni(Ⅱ) / {Zn(Ⅱ) + Ni(Ⅱ)} ratio. Ni content decreased in plated film increased with increasing of current density. Zn content in plated film was larger comparing with Zn (Ⅱ) ion in bath. Zn content in plated film decreased with increasing of Ni(Ⅱ) / {Zn(Ⅱ) + Ni(Ⅱ)} ratio. Current density was small and bath temperature was raised for increasing of Ni content.

The sonication was is powerful agitation by the cavitation. The operation current density was widen. The eectrodeposited films and electrochemical kinetics parameters were affected. The smooth and clear deposited nickel and zinc films obtained below 100 mA.cm^{-2} in sonication. The electrolyte bath composed of 0.06 mol/dm^3 $ZnCl_2.6H_2O$, 0.06 mol/dm^3 $NiCl_2.6H_2O$ and 75 g/dm^3 NH_4Cl, and adjusted to pH 9 with ammonia water. The bath used 100 cm^3. The cell (6 cm Φx 7 cm height) placed in an ultrasonic tank. The electrolyte maintained at 303 K. The working electrode was Cu sheet (99.9 % and 0.3 mm thick), with an active area of 1 cm^2. The counter electrode was Pt plate, with an active area of 2.5 x 4 cm, placed 3 cm from the working electrode. The plating carried out at a current density of 50 mA/cm^2 and charge of 50 C/cm^2. Ni(Ⅱ)/{Zn(Ⅱ)+Ni(Ⅱ)} ratio was changed. The alloy film deposited in the range of 0.25 ～0.75.The of peaks were confirmed with x-ray diffract analysis in those range. The current efficiency increased with increasing of current density. Ni content decreased and zinc content in deposited film increased with increasing of current density. Zinc content in deposited film was larger comparing with zinc(Ⅱ) ion in bath. Zn content in deposited film decreased with increasing of Ni(Ⅱ)/{Zn(Ⅱ)+Ni(Ⅱ)} ratio in bath. Zn content in deposited film increased with increasing of current density. The current efficiency increased with increasing of current density. The current density was small and bath temperature was raised for increasing of Ni content. The optimum conditions were as following: Ni(Ⅱ)/{Zn(Ⅱ)+Ni(Ⅱ)} ratio was 0.5. The current density was 50 mA/cm^2. The bath temperature was 303 ～ 323 k.

References

[1] O. Hammami, L. Dhouibi and E. Triki, Surface and Coatings Technology, In Press.
[2] L.M. Chang, D. Chen, J.H. Liu and R.J. Zhang, Journal of Alloys and Compounds, In Press.
[3] T.V. Byk, T.V. Gaevskaya, L.S. Tsybulskaya, Surface and Coatings Technology, 202 (2008) 5817-5823.
[4] M.G. Hosseini, H. Ashassi-Sorkhabi and H.A.Y. Ghiasvand, Surface and Coatings Technology, 202 (2008) 2897-2904.

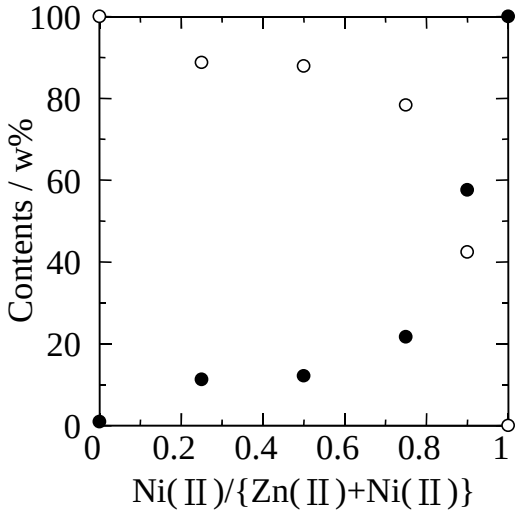

Figure 1: Effect of mol ratio of Ni in the bath on the content of Ni and Zn in films.
○: Zn, ●: Ni, Current density: 50 mA/cm^2, Quantity of electrocity; 50 C. /cm^2, Temperature: 303 K, Sonication: 30 kHz

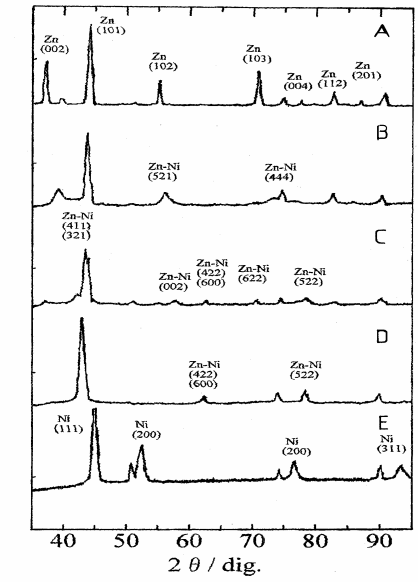

Figure 2: X-ray diffraction profiles of Zn - Ni plated films.
Ni (Ⅱ) / {Ni (Ⅱ) + Zn (Ⅱ)} ratio : A; 0, B; 0.25, C; 0.5, D; 0.75, E;1, Current density: 50 mA/cm^2, Quantity of electrocity; 50 C. /cm^2, Temperature: 303 K. Sonication: 30 kHz