Study of the stability of electroless cobalt-boron baths – E-WC project

Alexandre Mégret¹, Thomas Sibille, Véronique Vitry, Fabienne Delaunois
Metallurgy Lab, University of Mons, 56 rue de l’Epargne, 7000 Mons, Belgium

E-WC Project

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Goal: deposition of cobalt-boron on tungsten carbide particles by electroless plating to enhance the sintering behaviour of WC-Co parts.

Now: ball milling but lack of homogenisation of cobalt within WC particles.

Basis: electroless Ni-B plating (well-known in our lab).

Transposition to Co-B baths but lack of knowledge about their stability.

Experiments on steel substrates to evaluate the stability of Co-B baths.

Bath composition & parameters

Source of cobalt CoCl₂·6H₂O variable
Complexing agent C₂H₄N₂ 120 mL/L
Reducing agent NaBH₄ 0,602 g/L
pH regulator NaOH 160 g/L
Temperature: 95°C
Time: 30 to 60 min

Magnetic agitation

Evolution of the thickness of the coating as function of the cobalt chloride mass

- No deposition with 24 g/L formation of Co(OH)₂.
- Reducing the CoCl₂ content allows deposition.
- Much lower deposition rate than Ni-B.

Optical microscopy

➢ 12 g/L – 60 min
Highest thickness (2.5 µm in average for the baseline). High roughness.

➢ 6 g/L – 30 min
Not homogeneous (hills and valleys). Very high roughness.

Conclusion

- Formation of Co(OH)₂ in pH conditions that prevents deposition.
- Co-B Coating not homogeneous.
- Baths need to be further optimized.

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