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

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E-WC Project

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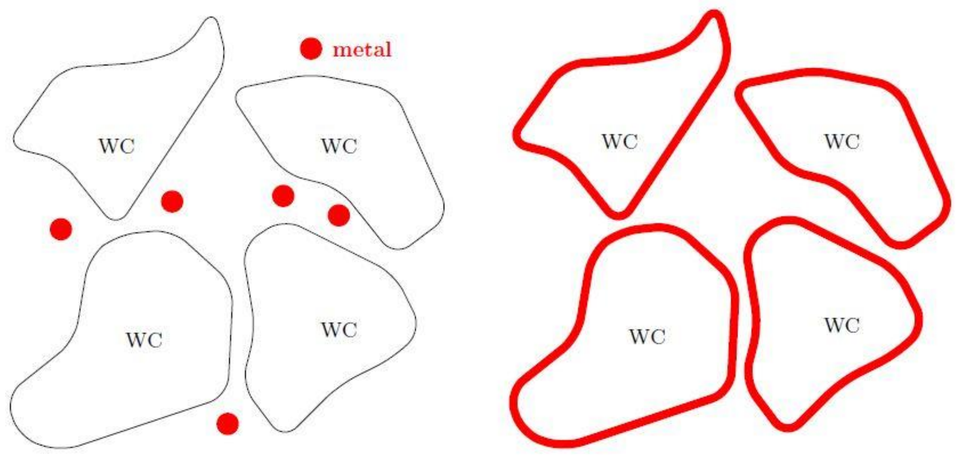
Goal: deposition of cobalt-boron on tungsten carbide particles by eletroless plating to enhance the sintering behaviour of WC-Co parts.

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



Ball milling **Electroless plating**

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

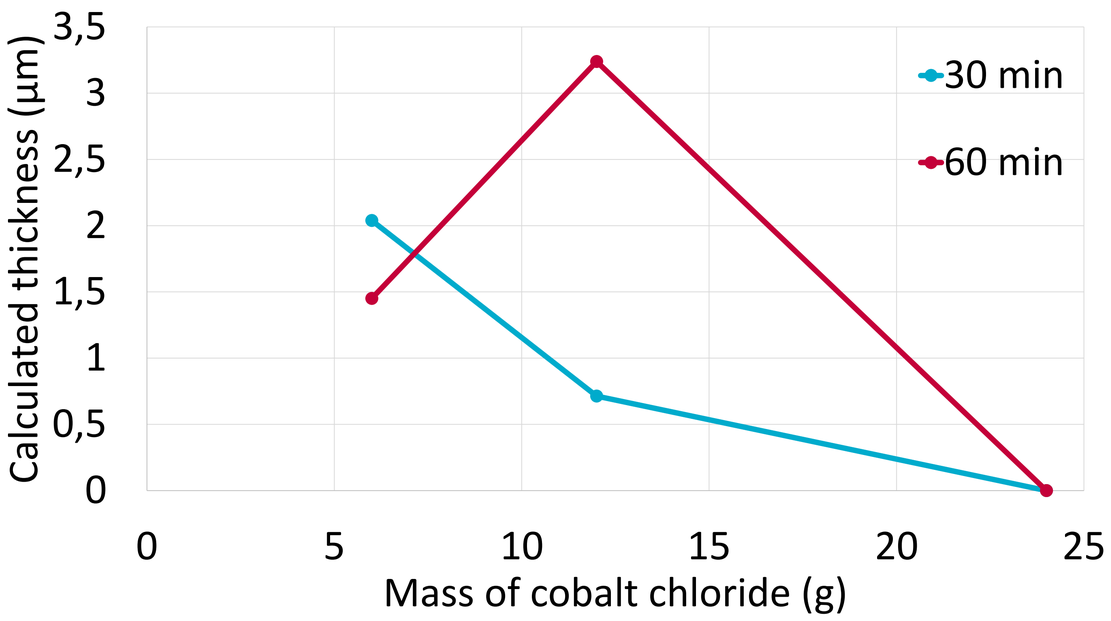
→ Transposition to Co-B baths but lack of knowledge about their stability.

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

Bath composition & parameters

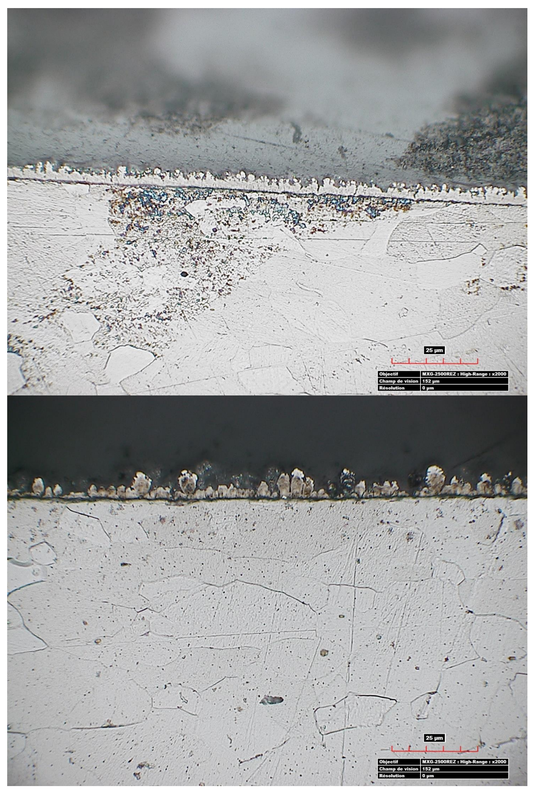
Source of cobalt	$CoCl_2 \cdot 6H_2O$	variable	pH regulator	NaOH 160 g/L
Complexing agent	$C_2H_8N_2$	120 mL/L	Temperature: 95°C	Time: 30 to 60 min
Reducing agent	$NaBH_4$	0,602 g/L	Magnetic agitation	

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 $CoCl_2$ 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.

Acknowledgements

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